A WORKING PLAN FOR THE FORESTS OF THE MADURA DIVISION

1936-37 TO 1945-46

BY

T. V. VENKATESWARA AYYAR, M.A.

(*Madras Forest Service*)

Under the direction of the Conservator of Forests, Working Plans Circle

TNFA - CBE
Centenary Library
00886

MADRAS

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

1938

PREFACE.

This is the first Working Plan covering the whole of the Madura Forest Division.

The No. III (Madura) Working Plans Division was formed on 14th December 1932 and was dissolved on 5th August 1935.

The Chapter on the Lac Working Circle and the Appendix dealing with lac products and the lac insect were kindly prepared by Mr. M. A. Hafiz, Acting Forest Utilization Officer.

Rangers K. Raghuraman, M. P. Philip, S. Narayanaswami Ayyar and K. Raghavan assisted the writer in field work, in compilation of statistics and other works. A number of foresters were engaged in enumeration and stock-mapping.

The writer takes this opportunity to express his thanks to the District Forest Officer, Madura, and his staff for the co-operation extended to him and his staff in the preparation of this plan.

COIMBATORE,
March 1936.

T. V. VENKATESWARA AYYAR,
Forest Working Plans Officer.

TABLE OF CONTENTS

Section PAGE

PART I.

Summary of Facts on which the proposals are based.

CHAPTER I.—THE TRACT DEALT WITH.

Section		PAGE
1	Name and situation	1
2	Configuration of the ground	1
3	Geology, rock and soil	2
4	Climate	2
5	Water-supply	4
6	Distribution and area	4
7	Legal position	5
8	State of boundaries	8
9	Rights and concessions	9

CHAPTER II.—THE FOREST.

Section		PAGE
1	Composition and condition of the crop	10
2	Injuries to which the crop is liable	17
3	Fauna	20

CHAPTER III.—UTILIZATION OF THE PRODUCE.

Section		PAGE
1	Agricultural customs and wants of the population	20
2	Markets and marketable products	23
3	Lines of export	27
4	Methods of exploitation and their cost	29
5	Past and current prices	31

CHAPTER IV.—STAFF AND LABOUR SUPPLY 35

CHAPTER V.—PAST SYSTEMS OF MANAGEMENT.

Section		PAGE
1	General history	36
2	Results of past systems of management	43
3	Grazing	70
4	Fire-protection	73
5	Special works of improvement undertaken	86
6	Protection of forest produce in transit	104
7	Administration	104
8	Past yield	106
9	Past revenue and expenditure	108

CHAPTER VI.—STATISTICS OF GROWTH AND YIELD.

Section		PAGE
1	Fuel	112
2	Timber	112
3	Lac	114

PART II.

Future Management discussed and prescribed.

CHAPTER I.—BASIS OF PROPOSALS.

Section		PAGE
1	General objects of management	118
2	Methods of treatment to be adopted	119
3	Working circles, their area and distribution, reasons for their formation	119
4	Recommendations of the Royal Commission on Agriculture	120
5	Period of the Working Plan and the necessity for intermediate revision	120

Section		PAGE
	CHAPTER II.—WORKING PLAN FOR THE SELECTION WORKING CIRCLE.	
1	General constitution of the circle and character of the vegetation	120
2	Division of the area	121
3	Analysis and valuation of the crop	121
4	Method of treatment	122
5	Exploitation	124
6	Regeneration	126
7	Subsidiary regulations	127
8	Miscellaneous prescriptions	127
9	Control	127
	CHAPTER III.—WORKING PLAN FOR THE CLEAR-FELLING WORKING CIRCLE.	
1	General constitution of the Working Circle and character of the vegetation ..	128
2	Division of the area	129
3	Analysis and valuation of the crop	129
4	Method of treatment	130
5	Regeneration	131
6	Subsidiary silvicultural operations	136
7	Miscellaneous prescriptions	139
8	Control	141
	CHAPTER IV.—WORKING PLAN FOR THE FUEL WORKING CIRCLE.	
1	General constitution of the circle and character of the vegetation	141
2	Division of the area	143
3	Analysis and valuation of the crop	146
4	Method of treatment	150
5	Regeneration	156
6	Subsidiary regulations	161
7	Control	162
	CHAPTER V.—WORKING PLAN FOR THE BRAKEPOLE WORKING CIRCLE.	
1	General constitution of the circle and character of the vegetation	165
2	Method of treatment	165
3	Method of executing the fellings	165
4	Regeneration	166
5	Control	166
	CHAPTER VI.—WORKING PLAN FOR THE BAMBOO WORKING CIRCLE.	
1	General constitution of the circle and character of the vegetation	167
2	Analysis and valuation of the crop	167
3	Method of treatment	167
4	Regeneration	171
5	Miscellaneous regulations	171
6	Control	172
	CHAPTER VII.—WORKING PLAN FOR THE SANDAL WORKING CIRCLE.	
1	General constitution of the Working Circle and character of the vegetation ..	172
2	Analysis and valuation of the crop	173
3	Method of treatment	174
4	Subsidiary silvicultural regulations	174
	CHAPTER VIII.—WORKING PLAN FOR THE MINOR FOREST PRODUCE WORKING CIRCLE.	
1	General constitution of the circle	178
2	Method of treatment	178
3	Planting of *Eriodendron anfractuosum*	179
4	Control	182
	CHAPTER IX.—WORKING PLAN FOR LAC WORKING CIRCLE.	
1	Basis of proposal	182
2	Analysis of the crop and division of the area	183
3	Method of treatment	183
4	Conversion and disposal of lac	187
5	Tabular statement of lac operations	190
6	Subsidiary silvicultural regulations	191
7	Other regulations : control	193

Section PAGE

CHAPTER X.—WORKING PLAN FOR THE PROTECTION WORKING CIRCLE.

Inaccessible areas and climatic forests 195

CHAPTER XI.—MISCELLANEOUS PRESCRIPTIONS.

1 Final demarcation 195
2 Disreservation 196
3 Boundaries of reserves 196
4 Maintenance of boundaries common to zamindaris 197
5 Fire-protection 197
6 Grazing 205
7 Thinnings in the Kodaikanal pine plantations 207
8 Roads, paths and bridges 208
9 Buildings and wells 210
10 Leases for cardamom cultivation 212
11 Sandalwood and Timber Transit Rules 214
12 Stores, Tools and Plant 214
13 Redistribution of beats 215
14 Matchwood 215
15 Control 216
16 Malarial prophylaxis 216

CHAPTER XII.—ESTABLISHMENT AND LABOUR.

1 Establishment 217
2 Labour 218

CHAPTER XIII.—FINANCIAL FORECAST AND COST OF THE WORKING PLAN.

1 Financial forecast 218
2 The cost of the plan 222

CHAPTER XIV.—SUMMARY OF PRESCRIPTIONS.

General facts and past working 225
Future management 226

APPENDICES 241

A WORKING PLAN FOR THE FORESTS OF THE MADURA DIVISION.

PART I

Summary of Facts on which the proposals are based.

CHAPTER I.—THE TRACT DEALT WITH.

SECTION 1.—NAME AND SITUATION.

1. This Working Plan covers all the forests of the Madura Forest Division, which includes the revenue district of Madura together with the Karur, Lalgudi, Trichinopoly and Kulitalai taluks of the adjoining Trichinopoly district.

2. The tract lies between north latitudes 9° 34′ and 11° 10′ and longitudes 77° 12′ and 79°, east of Greenwich.

3. A major portion of the western boundary of the area is formed by ridges of the Western Ghauts separating it from the State of Travancore.

4. All the reserved forests of the Trichinopoly district which are under the management of the forest department lie in the Kulitalai taluk : the activities of the forest department in the rest of the taluks mentioned above are confined to the management of the minor forest produce in their unreserves.

SECTION 2.—CONFIGURATION OF THE GROUND.

5. *Natural divisions.*—There are five well marked natural divisions in the district of Madura :—(*a*) the southernmost taluk of Tirumangalam, consisting of a level expanse of black cotton soil, dotted with a few granite hills, scanty of vegetation ; (*b*) the level tracts of riceland which cover most of Nilakkottai and Madura taluks and the southern half of Melur, irrigated with the water of the Periyar project ; (*c*) the dry expanse of red soil spreading across the north of Melur taluk and all Dindigul and Palni, generally resembling the adjoining Coimbatore district ; (*d*) the long Cumbum valley, in the south-west corner, which lies between the Western Ghauts and the Varushanad (Andipatti) hills, and is irrigated by the Vaigai, Surli and Periyar waters, being the greenest and pleasantest part of the district ; and (*e*) the Palni hills, an offshoot of the Western Ghauts jutting out eastward approximately into the middle of the district : the hillstation of Kodaikanal is set on the top of this offshoot.

The Kulitalai taluk differs little from the neighbouring Melur and Dindigul taluks, of which it may be considered to be a natural outlier, but at a lower general level.

6. *Mountain ranges.*—The hills of the division include :—(*a*) the broad mass of Palni hills referred to above and the eastern slopes of the Western Ghauts running southwards from them ; (*b*) the Varushanad and Andipatti ranges, being narrow hills running parallel to the Western Ghauts, to which they are joined at the basin of the Periyar lake ; (*c*) their snakelike continuation consisting of low hills, the Nagamalais, reaching nearly as far as the city of Madura ; (*d*) the Sirumalais, north-north-west of Madura, with which are associated Waguthumalai and the Sembatti hills ; (*e*) the Alagar hills to the north-east ; (*f*) the " Natham hills ", consisting of several groups round the town of that name, the chief of which are the Karandamalais ; and (*g*) the smaller similar hills round Aiyalur, known as the " Aiyalur hills ", to which the hills of Kulitalai taluk logically belong.

(*a*) *The Palni hills.*

7. The greatest length of this range (the Palnis) is forty miles and its greatest breadth, twenty-five. It is divided into two halves, the Upper Palnis and the Lower Palnis, the dividing line running north to south through " Neutral Saddle."

8. The Lower Palnis consist of a confused jumble of peaks from three to five thousand feet high, separated from one another by steep wooded valleys, in which thrive several small villages. The villagers cultivate coffee, cardamoms, turmeric, ginger and a peculiar aromatic plantain which goes on bearing for twenty years at a stretch without irrigation.

9. The Upper Palnis run from 6,000 feet to 8,000 feet in elevation, the highest point in the district being Vembadishola, 8,218 feet above Mean Sea Level. Kodaikanal stands on their southern edge. The tract consists largely of plateaux made up of rolling downs of coarse grass, interspersed with high level " temperate " shola in the sheltered valleys.

The soil is usually a thin layer of black peaty earth over yellow clay. The general fall is northwards, the slope in that direction being gradual, but on the south the hills terminate in precipitous cliffs of impressive beauty. Two great valleys on the north—Pumbarai and Vilpatti—lead up to villages bearing those names.

(*b*) *The Varushanad and Andipatti hills.*

10. The Varushanad hills, in which the Vaigai rises, may be considered to begin at Kottamalai, 6,617 feet, at the trijunction of Madura, Ramnad and Travancore. This tract of country was apparently Government land but was quietly annexed by the poligar of Gandamanayakanur in early unsettled times. On its western side lie the "High Wavy" mountains, a plateau rising gently from 4,000 feet to 6,000 feet and covered with evergreen forest, sold some seven years ago to the Madras Tea Estates, Limited, for cultivating tea. The range extends northwards into the Andipatti hills and ends in the Nagamalais.

(*c*) *The Nagamalais.*

11. *The Nagamalais*, a long straight ridge of rock of uniform height, support a scanty scrub.

(*d*) *The Sirumalais.*

12. *The Sirumalais* lie on the eastern side of the district, some sixteen miles north of Madura. They consist of a compact block about twelve miles across and their highest peaks are a little over 4,400 feet in elevation. On the top is a basin shaped plateau about 3,000 feet high, lying in the Ammayanayakanur Zemindari. Plantains and coffee (the latter introduced in 1838–40) are cultivated extensively, and cardamoms in some quantity.

(*e*) *The Alagarmalais.*

13. *The Alagarmalais* (named after the famous temple-fort at the foot dedicated to Alagar) lie north north-east of Madura, some ten miles away. They consist of a couple of ridges running north to south, enclosing two fertile valleys. The greatest length is ten miles and the highest point 2,637 feet.

(*f*) *The Karandamalais.*

14. *The Karandamalais* measure some six miles across and are crowned by a small plateaux on which are three hill-villages. On the southern slope is a perennial stream on the banks of which lies 'Kalanai', a hunting seat of a former poligar, now a cocoanut tope

SECTION 3.—GEOLOGY, ROCK AND SOIL.

15. Except for a narrow alluvial strip along the valley of the Vaigai river, the whole of the district is covered with gneissic rocks. Granular quartz is prominent in the Alagar hills. The Palnis are predominently Charnockite. Hornblende schists, penetrated by mica-bearing pegmatite, are found in the Varushanad and Andipatti hills.

16. Limestone occurs frequently and especially freely in the black cotton tract (Tirumangalam taluk).

Iron ore is found near Kottampatti (Melur taluk) and in the hills of the Kulitalai taluk of the Trichinopoly district. Several blast furnaces were extracting the metal in 1855. There is no smelting in progress now.

Gold has long been washed from the alluvium and sand of the red ground at the foot of the hill near the Palakanuttu travellers' bungalow but the quantity obtainable is so small that the goldwashers do not usually make more than they would by manual labour of the ordinary kind.

The streamlets forming the sources of the Vaigai and the Surli flow over limestone in places with the result that they manifest petrifying properties : stalactites, stalagmites and waterworn caves sanctified by shrines, are often met with in such localities.

17. Generally speaking the soil on the low hills is shallow, stony and dry. The Cumbum valley is an exception : here the soil is generally a deep sandy loam of reddish hue. The plateaux of the Lower Palnis, where the hill-plantain is widely cultivated, contain a rich loamy soil. On the Upper Palnis the soil is usually a thin layer of black peaty earth over yellow clay.

SECTION 4.—CLIMATE.

18. *Temperature and humidity.*—The extremes of shade temperature in the plains are between 60 degrees and 106 degrees Fahrenheit (Madura). The hottest part of the year

is April to June. Dindigul and Palni taluks are considerably cooler and drier than the southern taluks, generally. The heat in the Cumbum valley is reduced during the south-west monsoon by a pleasant breeze blowing down from the Western Ghauts.

The annual mean humidity of Madura is 70·2 per cent varying between 61·6 per cent and 78·8 per cent.

The extremes of shade temperature on the Upper Palnis (Kodaikanal) vary between 65° F. and 51° F. Frosts occur almost regularly during the months of December and January.

The range of variation in humidity on the Upper Palnis is phenomenal. Variations from nil to 98 per cent during the course of 24 hours have been recorded at the Kodaikanal Observatory in the months December to February. The mean annual humidity is 74 per cent.

An intermediate range of temperature prevails over the smaller hills.

The Trichinopoly district is warmer than the Madura district, generally.

19. *Rainfall and its distribution.*—Statistics of the average rainfall at various stations in the division are given below :—

Statement showing monthly and annual rainfall, in inches, at various places in Madura division.

Station.	January.	February.	March.	April.	May.	June.	July.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.
Natham	1·18	0·18	0·60	1·13	3·91	2·05	2·60
Melur	0·62	0·30	0·55	1·79	3·16	2·16	2·31
Sholavandan	0·79	0·39	0·37	1·44	3·00	1·37	1·87
Madura	0·60	0·40	0·51	2·03	2·89	1·57	1·92
Peraiyur	0·78	0·74	0·68	2·68	3·27	1·20	1·35
Tirumangalam	0·53	0·35	0·68	2·14	3·08	1·21	1·55
Usilampatti	0·83	0·56	0·88	2·39	3·30	0·85	0·92
Uttamapalaiyam	0·58	0·73	0·75	2·31	2·60	1·58	1·62
Bodinayakkanur	0·91	0·74	1·60	2·90	2·49	1·30	1·04
Periyakulam	1·13	0·98	1·82	2·97	2·99	0·97	0·95
Nilakkottai	0·61	0·38	0·60	2·03	3·03	0·83	1·05
Dindigul	0·73	0·45	0·62	1·96	3·03	1·84	1·36
Vedasandur	0·66	0·41	0·60	1·87	3·40	1·17	0·64
Chatrapatti	1·35	0·35	0·29	1·32	3·17	1·45	1·66
Palni	0·52	0·41	0·60	1·49	2·86	1·09	0·74
Kodaikanal	2·88	1·41	2·03	4·25	6·02	4·06	5·02
Manaparai	5·50	0·34	0·52	1·71	3·23	1·43	1·66
Marungapuri	5·24	0·27	0·41	1·37	4·02	1·67	2·25
Upper Konalar	4·70	0·77	1·85	3·71	5·71	3·47	3·90
Lower Konalar	4·34	0·84	1·77	3·89	6·57	3·24	4·08
Upper Pulavachiar	3·12	0·89	1·48	3·06	9·24	4·56	4·94

Station.	August.	September.	October.	November.	December.	Annual.
	(9)	(10)	(11)	(12)	(13)	(14)
	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.
Natham	3·47	5·73	6·33	6·88	2·70	36·76
Melur	4·98	5·51	8·13	5·11	2·73	37·35
Sholavandan	2·49	4·82	7·82	6·03	1·54	31·69
Madura	4·25	5·11	7·58	4·95	1·77	33·58
Peraiyur	2·79	4·01	7·22	6·40	2·21	33·33
Tirumangalam	3·56	4·33	7·92	5·16	1·82	32·33
Usilampatti	2·46	3·95	8·48	6·55	2·12	33·29
Uttamapalaiyam	1·28	1·70	7·17	5·61	2·11	28·04
Bodinayakkanur	1·53	2·00	6·67	5·58	1·69	28·45
Periyakulam	1·85	2·67	7·16	5·13	1·73	30·35
Nilakkottai	2·31	3·89	7·00	4·76	1·62	28·11
Dindigul	2·65	3·62	6·27	5·40	2·60	30·53
Vedasandur	1·67	2·94	6·38	4·36	2·31	26·41
Chatrapatti	1·66	2·54	9·01	7·55	2·67	33·02
Palni	1·99	2·07	6·86	6·13	2·52	26·48
Kodaikanal	6·99	7·25	7·35	8·17	4·42	62·18
Manaparai	3·19	4·86	7·15	5·63	2·86	33·36
Marungapuri	4·05	4·81	6·96	5·80	2·58	35·59
Upper Konalar	7·97	4·42	10·54	10·35	2·85	60·24
Lower Konalar	7·57	4·56	10·74	8·67	2·67	58·94
Upper Pulavachiar	7·41	2·50	8·89	8·35	2·17	56·61

NOTE.—The figures are averages for the past 15 years.

The following statement records the rainfall at the various stations maintained by the department :—

Range.	Station.	Altitude.	Average rainfall in inches for the past 12 years ending 1932.
Cumbum	Vannathiparai	1,460′ above M.S.L.	34·5
Do.	Cumbum	1,389′ above M.S.L.	24·7
Kodaikanal	Kodaikanal (Pambar hill up to 1923).	7,209′ above M.S.L.	61·9
Palni	Tandigudi	4,627′ above M.S.L.	33·7
Natham	Munnur	720′ above M.S.L.	26·9
Aiyalur	Aiyalur	1,100′ above M.S.L.	30·0

The average fall for the Madura district is nearly 34 inches, but the supply is very irregular though the major portion is received in the north-east monsoon.

The extreme variations in record are 47·41 inches in 1877, 18·60 inches in 1876, over 40 inches in 1898, and under 25 inches in 1870, 1873, 1881 and 1892.

Excluding Kodaikanal, where conditions are peculiar, the highest falls are received in Melur and Madura taluks and the lowest in Dindigul, Periyakulam and Palni. The difference is confined mainly to the precipitation during the south-west monsoon, that during the north-east being shared more equally by all parts. The last three taluks are situated close under the Western Ghauts and receive less rain during the south-west monsoon in consequence.

January-March are the driest months. A few thunder storms in April and May relieve the heat somewhat. October and November record the heaviest falls.

SECTION 5.—WATER-SUPPLY.

20. All the rest houses, forest or other, and all residential quarters, have unfailing supplies of water, either from wells or from streams. The well water is brackish in some cases but this is a drawback which cannot be easily remedied, as it is inherent in the localities.

21. The most important perennial streams are—

The Suruliar in the Cumbum valley, the Pambar near Periyakulam, the Manjalar and the Ayyampalaiyam stream near Devadanapatti, the Sathiar from the Sirumalais—all draining into the river Vaigai, from which the Periyar channel irrigates large areas of wet lands ; the Porundalar (Shanmuganadi), the Kudiraiyar and the Pachaiar draining the northern slopes of the Palnis into the Amaravati river ; and the Thirumanimuthar, fed by several small streams with sources on the Perumalais, the Alagar hills and the Karandamalais.

SECTION 6.—DISTRIBUTION AND AREA.

22. The tabular statement below gives the areas of reserves in each range. The Working Plan covers all the reserved forests in the division, extending over an area of 396,841 acres or 620·1 square miles.

District.	Range.	Number of reserves.	Area in acres, of reserved forests in the range.	Area in square miles.	Remarks.
Madura	Sholavandan	11	54,260·96	84·78	
Do.	Natham	21	67,837·34	105·99	
Do.	Cumbum	13	41,825·37	65·35	
Do.	Palni	26	74,196·28	115·93	
Do.	Kodaikanal	31	105,870·47	165·42	
Do.	Aiyalur	9	29,376·47	45·90	} 52,851·05 acres.
Trichinopoly ..	Aiyalur	18	23,474·58	36·67	} 82·57 sq. miles.
	Total ..		396,841·47	620·06 or 620·1 sq. miles.	

NOTE.—Reserves under panchayat management have been omitted. Net areas as they stand now have been entered, taking all additions and exclusions into account.

SECTION 7.—LEGAL POSITION.

23. All the forests covered by the Plan have been notified as reserved forests either under section 16 or under section 25 of the Madras Forest Act V of 1882, and are therefore the absolute property of the State.

In the case of some reserves the original notifications have had to be revised since the boundaries were defined very loosely therein, the areas resettled, and fresh notifications issued.

24. The following statement gives, rangewar, the name of each reserve, its area corrected up to date with reference to additions and disreservations, and the number and date of the order notifying it as a reserved fcrest, along with the number and date of the revised notification where there is any. Reserves notified under section 25 have been noted in the remarks column.

List of Reserved Forests—Madura Division.

Range.	Number.	Name of reserve.	Area in acres.	Number and date of notification.	Numbeer and date of revised notification.	Year in which permanently demarcated.	Remarks.
(1)	(2)	(3)	(4) ACS.	(5)	(6)	(7)	(8)
Sholavandan.	1	Sirumalai	21,785·60	187, dated 11th October 1883.	..	1909–10	Notified under section 25.
	2	Kachaikatti	1,259·02	136, dated 3rd April 1891.	..	1909–10	
	3	Sirumalai North-west Slopes.	5,475·16	31, dated 15th January 1900.	..	1919–20	
	4	Sembatti Hills	2,521·40	185, dated 7th April 1894.	..	1912–13	
	5	Sirumalai North-east Slopes.	767·55	296, dated 13th June 1896.	..	1909–10	
	6	Waguthumalai	5,917·93	135, dated 3rd April 1891.	..	1909–10	
	7	Vikramangalam ..	3,323·80	188, dated 11th October 1883.	..	1915–16	Notified under section 25.
	8	Andipatti, North ..	4,096·00	276, dated 15th May 1893.	..	1909–10	
	9	Andipatti, South ..	5,390·15	74, dated 6th February 1900.	..	1909–10	
	10	Rajadani	2,687·75	542, dated 3rd November 1893.	..	1912–13	
	11	Valayapatti	1,036·60	539, dated 10th October 1893.	..	1912–13	
		Total ..	54,260·96				
Natham ..	1	Alagar Hills	16,838·40	187, dated 11th October 1883.	..	1890–91	Notified under section 25.
	2	Kiluvamalai	2,182·40	46, dated 22nd January 1892.	..	1891–92	
	3	Sanamalai	448·00	436, dated 1st September 1896.	..	1915–16	
	4	Perumalai	6,112·00	245, dated 9th June 1890.	..	1921–22	
	5	Papanmalai	345·60	457, dated 10th September 1896.	..	1921–22	
	6	Chembulimalai	1,228·80	191, dated 5th May 1890.	..	1907–08	
	7	Mottamalai	235·80	58, dated 10th February 1891.	..	1917–18	
	8	Nedumalai	1,067·21	450, dated 13th August 1895.	..	1907–08	
	9	Budagudimalai	1,430·06	204, dated 19th July 1889.	..	1926–27	
	10	Pulamalai	907·70	59, dated 10th February 1891.	..	1907–08	
	11	Karandamalai	21,045·79	453, dated 15th October 1891.	..	1914–15	
	12	Karpuravallikutu ..	844·80	101, dated 19th March 1886.	..	1911–12	Notified under section 25.
	13	Tenkal	588·80	Do.	..	1918–19	Do.
	14	Erukkalamalai	3,647·25	72, dated 10th February 1900.	..	1910–11	
	15	Methugamalai	2,092·62	..	244, dated 4th June 1897.	1926–27	
	16	Nedunkuttu	928·20	184, dated 7th April 1894.	..	..	
	17	Chinnapattikaradu ..	625·00	459, dated 8th September 1896.	..	..	
	18	Kodangikuttu	3,231·00	140, dated 12th March 1894.	..	1912–13	
	19	Valacheripatti Hills ..	1,202·00	295, dated 9th June 1894.	..	1909–10	
	20	Karumalai	1,863·16	90, dated 22nd February 1896.	..	..	
	21	Vellimalai, Nedumalai ..	972·75	471, dated 13th September 1896.	..	..	
		Total ..	67,837·34				
Ayyalur ..	1	Mudimalai	4,435·20	187, dated 11th October 1883.	..	1909–10	Notified under section 25.
	2	Pillayarnatham ..	4,339·20	188, dated 11th October 1883.	..	1913–14	Do.
	3	Panchantangi	7,145·48	510, dated 15th October 1891.	..	1912–13	
	4	Tannirkaradu	966·40	101, dated 19th March 1886.	..	1904–05	Notified under section 25.
	5	Sundamalai	409·60	Do.	..	1908–09	Do.
	6	Pannamalai	1,158·35	169, dated 29th March 1893.	..	1907–08	
	7	Thoppasamimalai ..	8,532·40	453, dated 18th November 1901.	..	1911–12	

Range.	Number.	Name of reserve.	Area in acres.	Number and date of notification.	Number and date of revised notification.	Year in which permanently demaracted.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			ACS.				
Ayyalur—*cont.*	8	Mungilkaradu	1,756·34	268, dated 6th June 1896.	..	1909–10	
	9	Kaluvadimalai	633·50	555, dated 4th November 1893.	..	..	
	10	Minnakaradu	104·00	204, dated 4th December 1883.	..	..	
	11	Panchantangi Hill .. }	3,184·00 (for 11, 12 and 13)	352, dated 6th August 1891.	..	..	
	12	Panchantangi Valley. .. }					
	13	Sorupam .. .. }		248, dated 1st July 1887.	..	..	
	14	Viramalai .. .. }	6,714·89 (for 14, 15 and 16)	Do.	..	..	
	15	Naganur .. .. }		461, dated 4th October 1898. } 542, dated 1st December 1900. } 248, dated 1st July 1887. } (for 15, 16 and 17)	..	..	
	16	Aniyappur Blocks A and B. }			..	..	
	17	Poigaipatti Hill ..	615·27		..	..	
	18	Semmalai Block I .. }	4,019·00 (for 18 and 19)	Do. } 443, dated 3rd October 1890. }	..	..	
	19	Semmalai Block II .. }			330, dated 9th November 1922.		Numbers 10 to 27 are reserves transferred from Trichinopoly district
	20	Pakkirikaradu	64·66	248, dated 1st July 1887.	168, dated 12th June 1923.	..	
	21	Puthanatham	666·00	Do.	..	..	
	22	Seegankaradu	858·27	105, dated 28th February 1890.	236, dated 28th August 1923.	..	
	23	Methalamalai and extension.	500·00	85, dated 2nd June 1888.	87, dated 28th April 1921.	..	
	24	Karpur Reddiapatti Hill.	4,223·97	171, dated 27th April 1892.	..	..	
	25	Amayapuram	495·15	367, dated 14th July 1894.	107, dated 14th November 1918.	..	
	26	Kumarikatti Hill ..	1,557·00	439, dated 20th September 1898.	..	..	
	27	Mogavanur	472·37	356, dated 7th June 1910.	..	..	
		Total ..	52,851·05				
Cumbum ..	1	Kuttinachiar	2,016·70	160, dated 30th April 1886.	..	1890–91	
	2	Surulipatti	4,280·94	315, dated 7th September 1887.	..	1890–91	
	3	Pandarathorai	38·40	160, dated 30th April 1886.	..	1890–91	
	4	Vannathiparai	15,120·80	187, dated 11th October 1883.	..	1912–13	Notified under section 25.
	5	Melagudalur	1,292·80	94, dated 12th March 1886.	..	1911–12	
	6	Dhonikaradu	1,392·60	273, dated 15th May 1893.	..	1913–14	
	7	Puvuthukaradu ..	940·80	148, dated 20th March 1893.	..	1913–14	
	8	Buthakaradu	1,094·40	603, dated 12th December 1892.	..	1914–15	
	9	Kappavamadai	595·10	284, dated 29th June 1897. } 340, dated 25th October 1930. }	..	..	Class III, Reserve Forest.
	10	Suranganar	2,918·40	187, dated 11th October 1883.	..	1890–91	Notified under section 25.
	11	Machakkal	2,745·03	94, dated 12th March 1886.	..	1890–91	
	12	Kombai	9,079·60	517, dated 7th November 1892.	..	1890–91	
	13	Pannimuthukaradu ..	309·80	208, dated 21st April 1893 and 284, dated 19th September 1928.	..	1890–91	Class III, Reserve Forest.
		Total ..	41,825·37				
Palni ..	1	Maruthanadiar	4,906·80	187, dated 11th October 1883.	450, dated 12th September 1913.	..	Notified under section 25.
	2	Kaduguthadi	369·00	68, dated 28th February 1888.	170, dated 31st March 1913.	1914–15	
	3	Arunkanal	1,249·46	205, dated 20th July 1889.	49, dated 26th December 1910.	1922–23	
	4	Arunkanal Shola ..	32·00	187, dated 11th October 1883.	..	1922–23	Notified under section 25.
	5	Unjalnachi	520·00	54, dated 12th February 1891.	25, dated 26th December 1910.	1913–14	
	6	Pambukallar	660·00	187, dated 13th November 1883. } 188, dated 25th April 1898. }	.. 89, dated 20th February 1913.	1915–16	
	7	Kokkuparai	1,484·00	536, dated 20th November 1890.	296, dated 14th June 1913.	1917–18	
	8	Siruvatkadu	3,070·00	187, dated 11th October 1883.	384, dated 15th July 1913.	1914–15	Notified under section 25.
	9	Palni Hills N. Slopes and Nachiarkadu.	11,574·61	553, dated 19th December 1890 } 103, dated 15th February 1887. }	.. 353, dated 20th June 1911. }	1915–16	
	10	Vennilai	5,746·00	187, dated 11th October 1883.	..	1913–14	Notified under section 25.
				168, dated 2nd April 1900.	392, dated 19th July 1911.		
	11	Kaniankadu	2,495·00	187, dated 13th November 1883.	179, dated 9th April 1913.	1914–15	Do.
	12	Poombarai Vilpatty Valley	17,705·60	Do.	269, dated 28th May 1915.	1918–19	Do.
	13	Vilamkombai .. .. }	166·40 (for 13 and 14)	239, dated 22nd August 1885.	188, dated 11th October 1883.	1918–19	Do.
	14	Vilamkombai plantation }					
	15	Oliyanuthu Odai ..	4,352·00	70, dated 28th February 1888.	..	1889–90	

Range.	Number.	Name of reserve.	Area in acres.	Number and date of notification.	Number and date of revised notification.	Year in which permanently demarcated.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			ACS.				
Palni—*cont.*	16	Kudraiyar	10,545·20	187, dated 13th November 1883.	312, dated 12th June 1915.	1903–04	Notified under section 25 2,690 acres transferred to South Coimbatore.
	17	Mulaiyur	2,402·00	477, dated 27th Septebmer 1897.	580, dated 28th November 1913.	1914–15	
	18	Kallar	} 3,151·00	217, dated 27th July 1889.	..		
	19	Ariyanuthukanal ..		93, dated 12th March 1886.	..	1914–15	
	20	Kamangovaimalai ..		Do.	384, dated 13th July 1911.		
	21	Koviladi	360·00	317, dated 5th August 1903.	490, dated 18th October 1912.	1914–15	
	22	Kadavumalai	} 1,430·00	438, dated 8th November 1901.			
	23	Kadavu Shola		187, dated 11th October 1883.	248, dated 5th May 1119.	1913–14	Notified under section 25.
	24	Kodavanar and addition	108·56	188, dated 25th April 1898.	52, dated 62nd December 1910. 195, dated 13th June 1924.		
	25	Umaiyar	486·80	170, dated 2nd April 1800.	143, dated 9th March 1911.	1912–13	
	26	Karadikuttu	1,381·85	537, dated 18th October 1893.		1916–17	Class III, Reserve Forest.
		Total ..	**74,196·28**				
Kodaikanal	1	Tambirankanal ..	364·80	268, dated 8th September 1885.	..	1888–89	Notified under section 25.
	2	Agamalai	3,546·02	25, dated 15th January 1894.	..	1917–18	
	3	Amburuvi	8,756·78	112, dated 11th April 1888.	471, dated 8th August 1914.	1903–04	
	4	Sengalvaraiyar	4,502·50	187, dated 11th October 1883.	299, dated 7th June 1915.	1903–04	
	5	Karungal Donimedu ..	2,803·25	208, dated 20th May 1890.	200, dated 26th March 1914.	1903–04	
	6	Pambar	4,225·72	187, dated 11th October 1883.	327, dated 28th May 1914.	1891–92	Notified under section 25.
	7	Adukkam	5,627·11	340, dated 21st July 1890.	295, dated 27th April 1914.	1918–19	
	8	Murugamalai	6,904·54	389, dated 1st September 1891.	..	..	Notified under section 25.
	9	Palni Hills, S. Slopes ..	} 13,238·91	147, dated 7th April 1891.			
	10	Varattarkanal		103, dated 15th February 1889.	..	1919–20	
	11	Iruttarkanal			407, dated 6th August 1913.		
	12	Mankaradu	2,086·40	172, dated 5th April 1894.	328, dated 17th June 1911.	1908–09	
	13	Kukkal	866	187, dated 11th October 1883.	..	1903–04	10,858 acres transferred to South Coimbatore Division.
	14	Perumalmalai	} 6,509·00	256, dated 18th September 1888.			
	15	Thogavaraishola ..		187, dated 11th October 1883.			
	16	Thalayarkadu		160, dated 5th May 1886.		1903–04	Notified under section 25.
	17	Kadamaravu		103, dated 15th February 1887.	169, dated 12th March 1914.		
	18	Perumalmalai Shola ..	279·68	..	81, dated 12th February 1896.	1903–04	
	19	Anagiri Shola	76·16	86, dated 18th February 1899.	..	1903–04	
	20	Tigershola and addition.	1,260·08	..	460, dated 10th September 1896. 321, dated 30th October 1925.	1903–04	
	21	Glen Falls	36·48	109, dated 4th March 1896.	..	1903–04	
	22	Parappar	55·68	..	109, dated 4th March 1896.		
	23	Gundar Valley	4,590·08	109, dated 4th March 1896.	..	1903–04	
	24	Thalakadkanal	293·76	81, dated 12th February 1896.			
	25	Kuthukalkadu	36·48	Do.			
	26	Swamikanal	1,620·12	269, dated 4th June 1896.	..	1903–04	Notified under section 25.
	27	Keelanavayal	559·36	85, dated 15th February 1896.			Do.
	28	Poombarai	16·90	188, dated 11th October 1883.	..	..	Do.
	29	Gundar Valley extension.	5,888·76	355, dated 22nd September 1904.	..	..	Do.
	30	Ampthill Downs ..	31,725·90	70, dated 9th February 1906.	..	1903–04 (Sic.).	Do.
		Total ..	**1,05,870·47**				

25. *Sandal outside reserved forests.*—The Conservator of Forests suggested, in his Inspection Notes printed under C.C.P. No. 488, Press, dated 14th September 1930, that steps be taken to establish the right of Government to sandal on private land in the Madura district and that any sandal now growing on patta land may be acquired by purchase.

With a view to assess the value of all sandal trees growing on patta lands in the vicinity of reserves containing sandal, Range Officers were directed to count all such trees of any size. They were also directed to enumerate all sandal in unreserved and other land at the disposal of Government. The results of these enumerations made in 1932 are given below :—

Range.	Number of sandal trees enumerated in — Patta.	Number of sandal trees enumerated in — Unoccupied lands, unassessed and assessed.
Kodaikanal	255	Nil.
Palni	No enumerations.	270
Cumbum	1,624	110
Sholavandan	201	667
Natham	54	108
Aiyalur	105	43
Total ..	**2,239**	**1,198**

The enumerations disclose that the number of sandal outside the reserves is really too small, both in number and in size, to create any problems of management in the near future.

The Forest Department has not yet sold any sandal in this district though the species was noticed round about Pulathur some 70 years ago ; also, since the trees are felled by private parties long before maturity, as sapwood and immature heartwood can be sold to some profit, we need fear no competition or smuggling so far as mature sandal is concerned. No action appears, therefore, to be necessary for several years to come.

SECTION 8.—STATE OF THE BOUNDARIES.

26. The boundaries of the reserves require closer attention, generally speaking, both as regards the verification of their correctness and as regards general maintenance. Though in the neighbourhood of roads and where inspection has been comparatively frequent the lines have been cleared and the cairns maintained, there is much to be done in these directions in several places. Kodaikanal, Cumbum and Palni ranges require more attention in this matter than the other ranges.

27. The following reserves do not appear to have been demarcated after final notification under section 16 :—

Name of range.	Name of reserve.	Length of boundary in miles.	Remarks.
Kodaikanal	Murugamalai	20·83	No record of any demarcation.
	Talakadukanal	2·81	Do.
	Kuthukalkadu	1·12	Do.
	Keelanavayal	3·89	Do.
	Poombarai	0·80	Do.
	Gundar Valley Extension	5·25	Do.
	Parappar	1·38	Not demarcated after resettlement.
Natham	Nedunkuttu	7·31	Not demarcated permanently at all.
	Chinnapattikaradu	8·06	
	Vellimalai-Nedumalai	8·94	

28. In the case of 35 reserves which have been resettled and renotified, many were not redemarcated after the revised notification, so that disagreements seemed likely to exist between the actual and notified boundaries. Inspections in the course of the field work connected with this working plan disclosed that this was really the case.

With a view to reconcile all such differences, Mr. C. M. Kushalappa, Extra Assistant Conservator of Forests, was on special duty in 1932–33. He compared the actual boundaries of Budagudimalai, Karumalai, Vellimalai–Nedumalai, Nedunkuttu, Valacheripatti, Methugamalai, Chinnapattikaradu and Pulamalai reserves, of Natham range, with the notifications under section 16 and prepared revised boundary descriptions where considerable discrepancies were noticed between them. On approaching Government for notifying the revised boundaries, it was ruled that a revised boundary description not preceded by the usual settlement formalities prescribed under the Madras Forest Act would not be valid in law. The Government accordingly advised the continuance of the existing state of affairs until the Madras Forest Act had been suitably amended. The question of the revision of the boundaries has therefore been kept in abeyance for the time being.

29. It would be difficult, however, to mark the future fuel coupes on the ground if the maps did not indicate the correct boundaries as they actually exist. A comparison of the actual boundaries with those exhibited on the Survey of India maps disclosed serious

discrepancies in several instances. The forest boundaries as shown on the Revenue Survey (or Resurvey) maps were, however, found to be in close agreement with the actual boundaries. In order to check and discover these disagreements, the outer boundaries of such of the reserves as were not examined by Mr. Kushalappa were peregrinated and examined by the working plan party. Correct maps of the actual boundaries were then prepared by reduction of the village maps, where necessary, to a scale of 4″ = 1 mile, and this correction was entered on the Survey of India maps, which will be used in connexion with this working plan.

30. The discrepancies noticed between the section 16 notification and the actual boundaries. by the working plans party, will be found in Appendix I.

SECTION 9.—RIGHTS AND CONCESSIONS.

31. The rights admitted at the forest settlements of the various reserves will be found annexed to the section 16 (or section 25) notification of each reserve.

32. Concessions awarded after settlement are enumerated in the tabular statement below :—

Number and Reserved Forest.	Brief nature of concession.	Reference to order.
1 Gundar Valley Extension Reserved Forest.	Occupation of land for Observatory and residence of its Assistant Director, area 25·1 acres.	R. Dis. No. 14/1905.
2 Do.	To maintain a golf course	R. Dis. Nos. 52/1909 and No. 1344/1927.
3 Pillayarnatham Reserved Forest.	Permission to villagers of Pillayarnatham to water goats at a stream inside the reserved forest.	R. Dis. No. 111/1911.
4 Thoppasamimalai Reserved Forest.	Right of way for Kolathur to take grazing cattle through.	R. Dis. No. 138/1911.
5 Andipatti North Reserved Forest.	Right of way	R. Dis. No. 33/1912.
6 Machakkal Reserved Forest.	Right of way over Chellakoil footpath to Travancore.	R. Dis. No. 16/1912.
7 Kodavanar Reserved Forest.	Right of way for Mr. Bell	R. Dis. No. 28/1912.
8 Perumalmalai Reserved Forest.	Permission for the Public Works Department to do certain acts for the due maintenance of the Kodaikanal Ghat road.	R. Dis. No. 38/1917.
9 Do.	Permission to Rev. I. Duffo, S.J., to construct a specified bridle-path.	R. Dis. No. 419/1921.
10 Do.	Construction of a road from Motor Ghat road to Dairy farm. Permission to Procurator of Sacred Heart College.	R. Dis. No. 1473/1931.
11 Do.	Burial ground with access from Motor Ghat road. Admitted.	D. Dis. No. 1379/1932.
12 Sirumalai Reserved Forest.	Permission to Mr. D. K. Venkatarama Ayyar to construct and maintain a cart-track.	R. Dis. No. 72/1918.
13 Gundar Valley Reserved Forest.	Modification of rights of way admitted at settlement ..	R. Dis. No. 1006/1929.
14 Sembatti Reserved Forest.	Modification of the right of way admitted at settlement over the Ichikulam path.	R. Dis. No. 1954/1929.
15 Perumalai Reserved Forest.	Conceding a right of way to Viranilai villagers	R. Dis. No. 2285/1929.
16 Suranganar Reserved Forest.	Permission to the Public Works Department for constructing a stores shed.	D. Dis. No. 30/1923.
17 Kuttinachiar Reserved Forest.	Conceding a right of way	R. Dis. No. 544/1930.
18 Unjalnachi Reserved Forest.	Right for burial and cremation grounds	R. Dis. No. 547/1930.
19 Vikramangalam Reserved Forest.	Revised description of an admitted right of way ..	R. Dis. No. 1703/1930.
20 Karumalai Reserved Forest.	Right of way over a path from Tondilingapuram to Mudukkankadu.	R. Dis. No. 873/1931.
21 Dhonikaradu Reserved Forest.	For diversion of water from Kuttinachiar stream for irrigation.	D. Dis. No. 194/1932.
22 Kombai Reserved Forest.	For diversion of water for irrigation from a stream ..	D. Dis. No. 265/1932.
23 Vannathiparai Reserved Forest.	For diversion of water from the Eravangalar for irrigation.	D. Dis. No. 1300/1932.
24 Do.	India Tea Estates, Limited. Permission to construct a road through Poovathikaradu, Surulipatti, Kuthanachiar and Vannathiparai Reserved Forest.	R. Dis. No. 128/1933.
25 Do.	Mangaladevi temple. Right of way to Gudalur people and maintenance of the path.	R. Dis. No. 5/1933.
26 Alagar hills	Temple authorities. Alagar Temple to be given annual lease of the flower garden.	B.F. Mis. No. 1233, dated 30th November 1897.
27 Do.	Thethampatti village—Permitted to take cattle through the reserved forest.	
28 Do.	Alagar Temple Devasthanams pipe line from Thirthams admitted as rights.	R. Dis. No. 280/1933.
29 Melagudalur Reserved Forest.	Muhammadan burial ground. Two acres of land set apart and demarcated near Kumli.	R. Dis. No. 68/1915.

Number and Reserved Forest.	Brief nature of concession.	Reference to order.
30 Palni Hills Southern Slopes Reserved Forest.	Public Works Department permitted to maintain Kodaikanal Ghat road in reserved forest portion for a width 37½′ from the centre of the road. Within this width permitted to cut fuel for boiler.	R. Dis. No. 38/1917.
31 Do.	Area to the south of Tum-Tum parai toll-gate handed over to Public Works Department for coolie line construction.	....
32 Waguthumalai	Poochanpatti villagers permitted a right of way through reserved forest leading to a tank outside Reserved Forest.	R. Dis. No. 1624/1932.
33 Nedunkuttu	Right of way from Manjanaickenpatti to patta lands near Karai Amman Temple. Admitted.	R. Dis. No. 1748/1932.
34 Valacheripatti Reserved Forest.	Right of way from the Valacheripatti village to patta lands on the north side through reserved forest admitted.	R. Dis. No. 1548/1932.
35 Sirumalai North west slopes.	P. S. A. Savundayya Chetti of Chinnalapatti permitted to construct a well over an area of 5 cents on the right of way to Tholukadu.	R. Dis. No. 1656/1931.
36 Gundar Valley Extension Reserved Forest.	Golf course admitted on an annual licence	R. No. 935/1932.
37 Do.	Pillar rock's road was transferred to Kodaikanal Municipality for maintenance.	R. No. 214/1931.
38 Do.	Modification of the above right when the 12 miles round road was admitted.	....
39 Do.	Portions of the right of way No. I and the whole length of right of way No. II were extinguished by Government.	R. Dis. No. 214/1931.
40 Do.	Executive Engineer permitted to execute repairs and maintain the Kodaikanal Water-supply Reservoir.	R. Dis. No. 59/1911.
41 Ampthill downs Reserved Forest.	Executive Engineer permitted to maintain and execute necessary repairs to Berijem Reservoir.	R. Dis. No. 59/1911.
42 Do.	Pykara Hydro-Electric was permitted to construct new weir and maintain the new and old weirs in Konalar.	R. No. 246/1933.
43 Veeramalai Reserved Forest.	The Viamudi Kauriman temple, its lamp post and three springs called Kauriman, Adu and Naga springs have been admitted.	R. No. 564/1929.

CHAPTER II.—THE FOREST.

SECTION 1.—COMPOSITION AND CONDITION OF THE CROP.

33. The total area of all reserved forests in the Madura division managed by the Forest department is 620·1 square miles ; this excludes the Manjampatti block and portions of Kudiraiyar and Kukkal blocks of 26·73 square miles, recently transferred to the South Coimbatore division.

34. They fall naturally under three main formations—the mixed deciduous, the evergreen and the grassland formations, but may be classified under six main types not only to facilitate description but also to enable us to apply to each type the silvicultural treatment best suited to it, consistent with the objects of management.

35. The main types are—(*a*) the timber forests, (*b*) the low level sholas (evergreen forests), (*c*) the gallnut type, (*d*) the grassland type (including the high level sholas), (*e*) the fuel forests and (*f*) the plantations.

The prevalence of bamboos and sandalwood has also to be noticed.

(*a*) *The timber forests.*

36. This important type of the mixed deciduous formation is practically confined to the Cumbum, Kodaikanal and Palni Ranges. Of these three ranges the Cumbum range has the largest area of the best quality, from an elevation of about 1,500 feet on the plains to about 3,500 feet above sea-level.

37. Two main sub-types may be distinguished—(i) the plains sub-type that may be found in the Vannathiparai valley, at Pandarathorai, in the valley of the Vairavanar at the bottom of the Kumli Ghat road, and along streams on the Surulipatti plateau—all in Cumbum range ; on the alluvium on both sides of certain perennial streams, as in the Iruttar valley of the Kodaikanal range, the Velancombai and Kudiraiyar valleys of the Palni range and the Kalanai and Peria-aruvi valleys of Natham range and (ii) the hill sub-type covering slopes at elevations varying from about 2,500 feet to 3,500 feet.

(i) The plains sub-type is characterized by tall trees, reaching sometimes a height of 120 feet or more, with reasonably clean boles, and an understory usually devoid of grass. Girths up to 20 feet at breast height are not uncommon. The chief species found are—*Dalbergia latifolia, Pterocarpus marsupium, Schleichera trijuga, Mangifera indica, Grewia tiliaefolia, Tamarindus indica, Terminalia arjuna, Adina cordifolia, Albizzia lebbek,*

Albizzia odoratissima, Stephegyne parvifolia, Stereospermum chelonoides, Anogeissus latifolia, Melia dubia, Lagerstrœmia lanceolata, Artocarpus hirsuta, Dalbergia paniculata and *Cedrela toona.* Bamboos sometimes also occur as in the Vannathiparai and the Periaruvi valleys.

The forest in the Vannathiparai valley (total area 6,093 acres) compares not unfavourably with the best deciduous forests in the Presidency. Fine specimens of *Dalbergia latifolia* and *Adina cordifolia* may still be found in them, but their most conspicuous feature is the presence of a number of *Schleichera trijuga* of large dimensions, occupying gregarious patches of varying sizes. This feature makes the valley peculiarly suitable for the cultivation of "Kusum lac" (lac grown on *Schleichera trijuga*). Natural regeneration from seed of *Adina cordifolia, Schleichera trijuga, Dalbergia latifolia, Albizzia lebbek* and *Melia dubia* appears in considerable quantities.

The Kalanai valley of the Karandamalai hills (Natham range) is one of the four valleys in these hills in which timber forests of this sub-type may be found. The most remarkable feature common to these valleys is the existence of a number of large trees of *Artocarpus hirsuta, Bischofia javanica, Mangifera indica, Terminalia arjuna* and *Ficus callosa,* among other species. They are confined to a distance of about one chain on either side of the streams flowing through the valleys. Trees of *Artocarpus hirsuta* measure up to 20 feet in girth with a height of about 120 feet. Natural regeneration of this species in various stages is not lacking.

(ii) The hill sub-type is distinctly of a poorer quality, and is characterized by smaller girth and height and crooked boles, a more open canopy and an understory of tall grass. The chief species met with are—*Tectona grandis, Dalbergia latifolia, Phyllanthus emblica-Odina wodier, Pterocarpus marsupium, Shorea talura, Anogeissus latifolia, Stereospermum chelonoides, Buchanania latifolia, Cochlospermum gossypium, Sterculia foetida, Grewia tilioefolia, Terminalia tomentosa, Terminalia chebula, Terminalia belerica* and *Terminalia paniculata* (in Cumbum range), *Givotia rottleriformis* and *Gyrocarpus jaquinii.* The northern and southern slopes of the Palni hills, within the elevations indicated above, support forests of this sub-type. The tall coarse grass associated with it is perhaps a result of annual fires. Bamboos, both *Bambusa* and *Dendrocalamus,* are often met with, the former being confined to a narrow width on either side of streams.

The forests of the Surulipatti plateau allotted to sub-type (i) are really an intermediate stage between the two sub-types, caused by intensive annual fires in localities which originally belonged to the better of the two. The "elephant grass" (*Imperatum arundinaceum*) results in fierce fires here almost every year, the area being open to grazing.

The forests on the tops of the Karandamalais and the Sirumalais (Thadaganachi valley) where the trees seldom grow beyond pole-size may be considered to be a degeneration of sub-type (ii), due to poverty of soil on the hill tops. Natural regeneration from seed of *Shorea talura, Pterocarpus marsupium* and teak occasionally appears in amongst the grass.

(*b*) *The low-level sholas* (*evergreen type*).

38. In moist protected valleys between 3,000 feet and 5,000 feet above sea-level, an evergreen type of forest prevails in the Cumbum valley and on the Palni hills. It is surrounded by forests of a mixed deciduous type, and is not of vast extent, being confined to moist protected valleys. Transition stages between the two types may often be observed at the margins. The chief species that prevail are—*Bischofia javanica, Cedrela toona, Chukrassia tabularis, Elæocarpus tuberculatus, E. serratus* and *E. oblongus, Canarium strictum, Myristica sp., Lagerstrœmia lanceolata* and *Eugenia sp.*, with a sprinkling of *Michelia champaca* and *Acrocarpus fraxinifolius. Mesua ferrea* up to six feet in girth sometimes occurs along streams.

There is usually a second story of smaller trees, such as *Nephelium longana, Agrostistachys longifolia* and *A. indica, Euonymus quadrangularis,* etc. The margins of the sholas have invariably been eaten into by fires so that they must have been more extensive in the past.

Areas belonging to this type of forest are eminently suited to the cultivation of cardamoms (*Elettaria cardamomum*) under the shade of the standing trees, for which purpose they are in great demand. Their salvation from fires may be best achieved by allowing such cultivation therein, as the cultivators will take great pains to prevent their cardamoms from being burnt.

(*c*) *The gallnut type.*

39. The timber forests belonging to the hill sub-type gradually make room for the 'gallnut' type at elevations above 3,500 feet, with the decrease in the moisture-content of the atmosphere resulting from elevation combined with the dessication of the shallow soil

due to annual grass fires. These two conditions together force out most of the timber species found at lower elevations, giving place to scattered trees of *Terminalia chebula* (hence the name of the type) *Buchanania latifolia, Shorea talura, Pterocarpus marsupium* and *Phyllanthus emblica*, interspersed with much coarse tall grass and *Phoenix acaulis*. The canopy is very open and the trees are small and stunted. All the species mentioned above are very resistant to fire—hence their survival. But their regeneration is naturally scanty, though not entirely absent.

40. These forests cover an area of about 100 square miles and are found mainly on the upper slopes of the Palni hills, in the Kodaikanal and Palni ranges, though small patches may be seen on the Karandamalais and on the hills of the Cumbum range. They rise up to over 5,000 feet, in places, finally yielding place to the grassland formations characteristic of a sub-tropical climate.

41. This type is of considerable economic value on account of the large quantities of gallnuts it yields every year. The revenue derived from leases of this produce in the Kodaikanal and Palni ranges is tabulated below, for the last 10 years :—

Year.	Lease value. RS.	
1925–26	7,900	Other minor forest produce were also included but myrabolans are the chief produce.
1926–27	5,155	
1927–28	12,000	
1928–29	8,350	
1929–30	7,925	
1930–31	7,955	
1931–32	2,015	Myrabolans only sold separately.
1932–33	1,026	
1933–34	5,000	
1934–35	4,090	

(d) The grassland type.

42. The grassland type is characteristic of the rolling downs of the Upper Palni plateau in the Kodaikanal range, at elevations above 6,000 feet, approximately. The Ampthill Downs Reserve, which is typical, is entirely composed of undulating stretches of extensive grassland through which meandering streamlets, originating in a few comparatively small ' islands ' of high level shola (sub-tropical evergreens), wind leisurely until they mingle and emerge as rivers worthy of the name and serve to irrigate extensive fields in the hot dry plains below. The soil on which the grass grows is of a dark peaty structure, which absorbs and retains a certain amount of moisture. In wet places bracken covers the ground almost to exclusion.

43. Extensive areas within the grassland have been set apart as unreserves for the villages of Poombarai, Kukkal, Kavunji and others, within which unrestricted free grazing and firing of grass is permitted. All sholas (sub-tropical evergreens) which existed in these unreserves have practically vanished, owing to unrestricted collection of fuel therefrom combined with the fires. Their former existence is only indicated by a shrubby growth of *Sarcococca pruniformis, Rubus ellipticus, R. lasciocarpus, R. latifolia*, and a few reeds.

44. Outside the unreserves and practically confined to the watershed forming the southern boundary of the plateau, are a few patches of shola protecting the headwaters of streams flowing northwards across the plateau. Elsewhere on the rolling grassland may be seen occasional open patches of *Rhododendron arboreum*, in various stages of degeneration resulting from fires and strongly indicative of the wider prevalence of the sholas in days long gone by. Mixed with such patches are shrubs of *Gaultheria fragrantissima* (the wintergreen) *Dodonaea viscosa, Photinia sp. Rubus sp., Hypericum mysorense* and *Osbeckia sp.*, fighting a losing battle against the fires to re-establish the old shola.

The sholas, of which there are about 250 in number, vary in size from 1 acre to 800 acres. They cover an area of about 4,400 acres only ($6\frac{1}{2}$ square miles) in aggregate, being little more than islets in an ocean of highly inflammable grass which extends over some 75 square miles.

45. Their insignificant aggregate area might be used as an argument against any useful purpose they can serve but it is the key positions they occupy at the very *heads* of streams, that exhibit effectively their indispensible function in the economy of nature in initiating the water supply of this important plateau. The streams which originate in these sholas are the very life-blood of the villages of the Upper Palnis, depending as they do on crops irrigated with their waters. And their importance for the irrigated plains below can hardly be over-estimated. Their continued protection is therefore imperative.

46. The sholas do not contain any useful timber. The trees vary in height from 30–50 feet, diminishing with increase in elevation. The chief species met with are :—

Elaeocarpus ferrugenius, *Elaeocarpus munroii*, *Elaeocarpus serratus*, *Eugenia sp.*, *Litsaea stocksii*, *Actinodaphne hookeri*, *Rhododendron arboreum*, *Cinnamomum sp.*, *Gordonia obtusa*, *Heptapleurum racemosum*, *Vaccinium neilgherrens*, *Pygeum gardneri*, *Photinia notoniana*, *Mahonia leschenaultii* and *Turpinia nepalensis*.

The margins of the sholas are usually singed by fire and in this margin may be found :— *Rhododendron arboreum*, *Wendlandia notoniana*, *Symplocos spicata*, *Dodonoea viscosa*, *Gaultheria fragrantissima*, *Photinia notoniana* and *Hypericum mysorense*.

(e) *The fuel forests.*

47. This is economically the most important type in the division. It comprises the open deciduous forests in (1) the lower slopes of the Palni hills, in the Palni and Kodaikanal ranges, (2) the lower slopes of the Western Ghats and the Varushanad hills in the Cumbum Valley and (3) the plains and low hills of the east and north-east portions of the district of Madura and the south-western corner of the Trichinopoly district, included in the Sholavandan, Natham and Ayyalur ranges.

Their total area is some 261 square miles and they constitute the fuel reserves of the city of Madura, principally, and of the villages and smaller towns in general.

48. The most abundant fuel species occurring in these forests are :—*Albizzia amara*, *Chloroxylon swietenia*, *Acacia latronum*, *Canthium didymum*, *Albizzia lebbek*, *Albizzia odoratissima*, *Atalantia monophylla*, *Wrightia tinctoria*, *Cassia marginata*, *Hemicyclia sepiaria*, *Acacia ferruginea* and *Acacia planifrons*. Less important species that occur are :—*Cordia. sp.*, *Dichrostachys cinera*, *Gyrocarpus jaquinii*, *Givotia rottlereformis*, *Randia dumetorum*, *Acacia intsia*, *Euphorbia trigonum*, *Pterolobium indicum*, *Dodonoea viscosa*, *Cassia montana* and *Moringa pterygosperma*.

49. It is worthy of note that *Acacia planifrons* is not found in Natham range, and in the Sholavandan range it is practically confined to the Andipatty reserve. It is common in Ayyalur range and not rare in Cumbum, Palni and Kodaikanal ranges.

Albizzia amara, on the other hand, is more widely prevalent in Natham, Sholavandan and Ayyalur ranges, than in the other three.

50. Generally speaking the growth is satisfactory, except in reserves within easy reach of Madura (Alagar hills, Waguthumalai, Andipatti hills, Nagamalais) and therefore over worked in the past and always subject to intensive illicit fellings. Illicit fellings are also prevalent in the vicinity of villages which have no unreserves for their fuel, e.g., Puthanatham Reserved Forest, Nagamalais and Thopaswamimalai Reserved Forest.

In moist localities a mass of *Acacia intsia*, *Zizyphus oenoplia* and *Barleria acuminata* have swamped much coppice regrowth, as in the Vannathiparai valley and Suranganar series of Cumbum range and along the Iruttar valley of Kodaikanal range. *Barleria acuminata*, *Stenosiphonium russellianum* and *Acalypha fruticosa* often form an impenetrable undergrowth elsewhere in many places. These appear to have retarded natural regeneration from seed also to a considerable extent.

51. One satisfactory feature, however, is the disappearance of prickly-pear (*Opuntia dillenii*) over extensive areas previously infested by it, as may be gathered from the old stockmaps. The cochineal insect has been responsible for this rapid extermination. The decomposition of the dead pear has apparently created soil conditions favourable to the natural regeneration from seed of species like *Albizzia amara* and *Acacia latronum*, seedlings of which may occasionally be seen where such conditions prevail.

52. There are indications that the stumps of the valuable species which have failed to throw out shoots have not been replaced in sufficient quantity by natural regeneration from seed of equally valuable species. The percentage of valuable species appears to depreciate after a coupe is felled. On the other hand softwooded and valueless species such as *Gyrocarpus jaquinii*, *Euphorbia antiquorum*, *Givotia rottleriformis* and *Moringa pterygosperma* have sometimes invaded the ground and displaced the valuable species to an appreciable degree. Certain areas have indeed a high proportion of *Dodonoea viscosa* and *Euphorbia antiquorum*.

53. In the open scrub characteristic of areas which were under cultivation some time before reservation, the regeneration of valuable species is almost absent, but the first stage in natural recovery has been achieved by the invasion of *Dodonaea viscosa* and *Randia dumetorum*. This process will have to be accelerated artificially if any tangible results are to be achieved.

54. Coppice regeneration is generally satisfactory, especially in the case of *Albizzia amara* and *Acacia planifrons*, two of the more important fuel sepcies, but old defunct stumps require replacement.

Artificial regeneration from seed is therefore absolutely necessary in order to improve the stock and prevent further deterioration of the forests.

(*f*) *The plantations.*

55. The chief plantations in the division are the teak plantations at Vannathiparai and Velancombai, the Eucalyptus and pine plantations near Kodaikanal, the wattle plantation at Poombarai, and the few Mahogany trees at the holy spring in the Alagarhills reserve.

56. *The Vannathiparai teak plantations.*—The 1869 plantation now contains 156 trees of the girth classes noted below :—

Girth class.	Number of trees.
Under 3′	1
3′—4′	23
4′—5′	69
5′—6′	52
Over 6′	11
Total ..	156

The bark of many of the trees has been damaged by wild elephants and some are going stagheaded. It is desirable to clearfell the plantation.

The plantations of 1920, 1921 and 1922 are poorly stocked. The saplings are being systematically damaged by elephants so that the only plants in evidence are young coppice shoots arising from the broken down saplings awaiting their turn to be similarly treated.

The 15 acres regenerated under Mr. Sundaram's scheme in the Vannathiparai Valley (five acres in each of the years 1928, 1929 and 1930) are well stocked with teak, *Dalbergia latifolia*, *Pterocarpus marsupium*, *Albizzia lebbek*, and *Melia dubia*. The *Melia dubia* came in naturally in part as well as a few *Dalbergia latifolia* and *Albizzia lebbek*. The predominating species are teak and *Dalbergia latifolia*. The teak are being regularly broken down by elephants and are in a condition similar to those in the 1920–22 plantations. The elephants do not damage the other species and the *Dalbergia latifolia* has grown particularly well.

57. *The Velancombai teak plantations.*—The 1870 plantation now contains 477 trees of the following girth classes :—

Girth class.	Number of trees.
Below 1′	80
1′—2′	61
2′—3′	85
3′—4′	130
4′—5′	73
5′—6′	25
Over 6′	23
Total ..	477

Trees adjacent to irrigation channels have grown particularly well. The coppice shoots from past thinnings may be considered as failures as they are suppressed and are mostly under a foot in girth. Thinnings have not been sufficiently heavy with the result that there are a large number of suppressed trees which are not likely to respond to further thinning now.

The plantations of 1921 and 1922 are poorly stocked, and the growth is very uneven. The average girth is about 16 inches, and the height, 40 feet. There are about 150 stems to the acre.

58. *The Gundanshola Eucalyptus plantation.*—The various units of this plantation of *Eucalyptus globulus* are from 35 to 47 years of age. The growth is fairly uniform over the whole area. For want of proper thinnings at an early age the majority of the trees are in a suppressed condition and have small crowns and are poorly developed, with the exception of a few large dominant trees which have developed good crowns and are over 4 feet in girth. The quality appears to be poorer than the best Nilgiri Eucalyptus grown under high forest. An average outturn of 150 tons of fuel may be expected by clearfelling an acre.

59. *The pine plantations.*—The pine plantations in the Gundar Valley were raised between 1906 and 1915 over a total area of 928 acres. A large number of exotic conifers were

tried, the chief of them being *Pinus insignis*, *Pinus attenuata*, *Pinus coulteri* and *Pinus maritima*. The disastrous fire of 1920 wiped out an area of 543 acres, leaving a balance of 385 acres. *Pinus insignis* forms about 80 per cent of the surviving crop. In 1930 a cyclone caused further damage by blowing down a large number of trees.

The average height of trees in the plantations is about 50 feet and the average girth about 4 feet. The trees are shallow rooted and windfalls are common, more so because the plantations have not been thinned ever since they were formed. Species not suited to the locality have been dying a natural death, no doubt accelerated by the 1920 fire. Masses of dead and windfallen trees are consequently a characteristic feature of many of the plantations. The trees have completely vanished from some of the areas burnt in 1920, while a few pine may still be seen in the others, dotted about in a sea of grass. These untidy masses of dead and windfallen pine trees are a potential source of danger to the continued existence of the plantations in the event of a repetition of the fire of 1920 : nor do they present an æsthetic appearance.

Some natural regeneration of pine may be observed along roadsides and in areas swept by light grass fires. Where mother trees of *Acacia melanoxylon* or *Acacia decurrens* occur in the neighbourhood of gaps, natural regeneration of these species is abundant, both from rootsuckers and from seed. Other gaps have usually been invaded by *Rubus ellipticus*, *Rubus lasciocarpus*, *Polygonum* sp. and other shrubby growth.

60. *The Poombarai wattle plantation.*—The plantation of Australian wattles at Poombarai was raised in 1883–84 and is 16·9 acres in extent. The predominating species is *Acacia decurrens*, but there are a few *Acacia melanoxylon* and two trees of *Eucalyptus globulus*. Nothing appears to have been done after the planting except the removal of dead and windfallen trees about the year 1921.

Almost all the trees originally planted have bent over so that they are almost on the ground or are leaning over at an acute angle. Much of the dead wood is in a condition of decay. The ground is covered with a mass of natural regeneration, in all stages of development, from rootsuckers and from seed, which is crying for light. Illicit cutting and removal may be witnessed all over the area. Most of the *Acacia melanoxylon* is heavily infested with *Loranthus* and some is so badly parasitised that nothing but the parasite meets the eye on looking at the trees.

61. *The Mahogany plantation.*—The small plantation of *Swietenia macropyhlla* near the holy spring in the Alagarhills reserve was raised in 1889 and now contains 26 trees. The best tree is over six feet in girth. There is some natural regeneration under the mother trees. The bases of the trees are being damaged by pilgrims who light fires underneath them. The plantation needs to be thinned.

62. *Sandalwood.*—The occurrence of sandalwood in the neighbourhood of Pulathur in the Lower Palnis was noticed as long ago as 1863 when it was stated that "the Pulathur sandalwood jungles were improving."

In the Working Plan for the fuel forests of the Madura district written in 1915–16, Mr. C. C. Wilson brought to notice the occurrence of sandal over about a hundred acres in the Sathiar Valley of the Sholavandan range, over 1,000—1,500 acres on the northern slopes of the Sirumalais (Endlaparai) and a few trees on the Karandamalai plateau.

63. Further inspections have revealed the prevealence of sandal in the following localities :—

(1) *Palni and Kodaikanal ranges.*—Sandal is found on both sides of the ghat road from the 6th mile up to the 11th mile. It occurs along the Mulaiyar river in the abandoned cultivation near Keevalam. It is common round about Pulathur village and in the Unjalnachi and Marudanadiar reserves. There is also a patch of about 50 acres of poor sandal near Pachalur at an elevation of over 4,000 feet. The total sandal bearing area in these two ranges is about 1,600 acres.

(2) *Natham range.*—In the Natham range there is a patch of about 50 acres on the Karandamalai plateau on both sides of the path from Malaiyur to Jhendamedu. Sandal has also made its appearence in the Perumalai reserved forest adjoining the boundary of the enclosure of Malaiyur on the plateau. A few trees have spread into the Alagarhills reserve from the temple garden at the foot.

(3) *Sholavandan range.*—There is a patch of about 80 acres in the Sathiar Valley and about 10 acres in Sorandamalai near Valayapatti. It occurs more freely on the northern

slopes of the Sirumalais and is spreading rapidly into the Endlaparai fuel series. The execution of fuel fellings in coupes adjacent to sandal trees appears to be a direct invitation to the sandal to spread into the felled area. The total area covered by sandal in this locality is about 750 acres.

(4) *Cumbum range.*—A patch of sandal covering an area of some 180 acres occurs in the Kombai reserved forest.

64. The total sandal bearing area in the division as calculated from stockmaps prepared by the Working Plans staff is therefore about 2,740 acres, distributed as shown below :—

Range.	Sandal bearing areas.
	ACS.
1 Kodaikanal	1,140
2 Palni	510
3 Sholavandan	840
4 Natham	70
5 Cumbum	180
6 Ayyalur	Nil.
Total ..	**2,740**

65. The trees in certain localities were enumerated by the district staff from 1929 to 1931 : the results are tabulated in Chapter VI of Part II.

66. As has been already stated, the occurrence of sandal on the Lower Palnis was noticed as early as 1863, i.e., over seventy years ago. One would therefore expect to see trees of considerable dimensions in that locality but actually very few trees above a breast-height-girth of 24 inches may be observed. The only explanation that can be put forward is illicit removal as soon as trees have grown sufficient heartwood to make the risk worth taking. Illicit fellings have been freely noticed in this locality. The removal of bark for chewing purposes is also not uncommon.

Trees up to 18″ in girth occur on the higher slopes of the Sirumalais, in the Sathiar Valley and on the Karandamalais. Elsewhere the sizes met with are smaller. The invasion into the Endlaparai fuel series is more recent and only young saplings are met with but they occur in large numbers.

No spike has been observed so far. The tending that they have received has been satisfactory in the main.

67. *Bamboos.*—The bamboos in the division are mainly confined to the Palni, Kodaikanal and Cumbum ranges, with the exception of 70 acres of well grown *Bambusa arundinacea* in the main northern valley of the Alagarhills in the Natham range.

Both *Bambusa arundinacea* and *Dendrocalamus strictus* occur but the former is usually confirmed to a narrow belt along streams, except in the Kudiraiyar Valley of Palni range where it is more extensive. The proportion in which *Bambusa* and *Dendrocalamus* occur is about 4 : 1 in the Palni range, and 8 : 1 in the Kodaikanal range. There is not much *Dendrocalamus* in the Cumbum range.

Bambusa occurs mainly at elevations between 1,000′ and 2,500′ whereas *Dendrocalamus* is more prevalent between 1,800′ and 3,500′.

The gregarious patches of *Bambusa* found in the Kudiraiyar Valley are characterised by the presence of tall well grown specimens of *Acacia leucophloea* growing in their midst.

68. *Bambusa* has been subjected to heavy overcutting in the past in localities comparatively easy of access, amounting to almost clearfelling of clumps in some cases. This has resulted in the gradual disappearance of bamboos from the nearer localities. Unless the fellings are controlled more strictly there is a real danger of this species disappearing from the division at no distant date.

69. *Dendrocalamus* was observed to be flowering sporadically in 1935 in the Kudiraiyar Valley of the Palni range.

A general flowering of *Bambusa* appears to have occurred in the years 1924–27 over the whole district.

70. The bamboo bearing area in the division is distributed as follows :—

Range.	Area in acres. (Net.)
Palni Range	10,830
Kodaikanal Range	2,130
Cumbum Range	3,810
Natham Range	70
Total ..	**16,840**

SECTION 2.—INJURIES TO WHICH THE CROP IS LIABLE.

71. *Fire.*—Forest fires do considerable damage almost every year to the open pole areas on the tops of the Karandamalais, the Sirumalais and the Alagarhills, by killing outright any young natural regeneration of tree species. Sandalwood trees and seedlings where they occur suffer much from this source, but for which a much more rapid spread of this species would have resulted, as may be witnessed on the Perumalai plateau and in the Endlaparai Fuel coupes, where fires are less severe.

The upper slopes in the Cumbum, Palni and Kodaikanal ranges, above the boundary of the fuel felling series, also suffer in a similar manner.

The rolling grassy downs of the Palnis, a large part of which is open to free grazing, are subject to annual fires which singe the edges of the several sholas in their midst and thus tend to eat into and ultimately destroy the sholas. These sholas are of primary importance in conserving the water supply of the streams which feed irrigation channels, so that their damage by fire will have far-reaching effects, though this may not be apparent in the near future.

Over 500 acres out of a total planted area of 928 acres of the pine plantations near Kodaikanal were wiped out by incendiarism in the year 1920 (February). What has not been destroyed is in a messy and inflammable condition on account of masses of dead pine in its midst, partly as a consequence of this intense fire, and partly due to subsequent windfalls.

Fires do not as a rule pass over fuel coupes as grass is scarce in such localities on account of the coppice shoots and the mass of climbers and shrubs that usually cover the ground soon after felling.

72. *Winds.*—High winds which blow eastwards during the south-west monsoon do not cause appreciable damage to the fuel forests of the lower hills, but cause wind-falls in the pine plantations near Kodaikanal, almost every year. These plantations have not been thinned since their formation and are therefore very vulnerable to winds. In May 1930 a heavy cyclone caused great devastation by uprooting or breaking the crowns of over 30,000 pine trees.

73. *Frost.*—Frost occurs annually between December and February on the Upper Palni plateau of the Kodaikanal range. Heavy casualties among pine seedlings have been recorded on this account when the plantations were formed. Seedlings of *Acacia decurrens, Acacia dealbata* and *Acacia melanoxylon* now being raised as firebelts to sholas have to be protected by a covering of bracken during the frost season.

74. *Fungus.*—The pines in the Kodaikanal plantations are infested with a fungus which has not been identified.

75. *Parasites.*—A species of *Loranthus* is a serious pest of *Acacia melanoxylon* on the Upper Palnis, e.g., Poombarai Wattle plantation.

76. *Drought.*—Owing to uncertain and prolonged breaks between the South-West and North-East monsoons, seedlings which have commenced their life in June or July sometimes fail to survive through the intervening drought except in years in which the distribution of rainfall has curtailed this difficult period. On the other hand, provided there has not been a long break between the two monsoons, such seedlings have better chances of surviving through the subsequent hot weather than October seedlings. This point bears directly on the prescriptions for the artificial regeneration of felled coupes.

77. *Man.*—Illicit fellings for timber are frequently noticed in the forests of the Cumbum valley. This rich and fertile tract of country is inhabited by the " Kallars ", a tribe notified under the Criminal Tribes Act. There is at present no provision for the extraction of timber to meet the legitimate demands of the population. A considerable quantity of timber is imported from Travancore but this has not prevented theft of timber from the reserved forests of the Cumbum range.

Illicit removals for agricultural implements are sometimes noticeable where unreserves are very far from cultivated lands.

Considerable theft of fuel takes place from reserves mainly in localities from which it is easy to transport it to Madura, as from the Alagarhills, Kiluvamalai and Vikramangalam. Thefts are also committed by villagers who have no unreserves in their neighbourhood, or other sources of fuel for domestic needs, as in the case of Puthanatham.

Fibre from the bark of *Acacia planifrons* is often removed illicitly for the purpose of making ropes.

Illicit cutting of sandalwood occurs where the presence of heartwood is suspected, in the sandalwood areas of the Lower Palnis. Sandal was observed in the Lower Palnis as early as 1863–64, yet very few trees may now be seen above a girth of 12″. This can be due to theft alone.

The subjoined statement exhibits the number and nature of the forest offences detected in the Madura forest division from 1926 to 1934, together with the compounding fees realised :—

Statement of forest offences in Madura division—1926–34.

Year.	Range.	Number of offences detected.					Compounding fees collected.
		Illicit grazing.	Illicit felling.	Incendiarism.	Miscellaneous.	Total.	
							RS.
1926–27 ..	Sholavandan ..	49	339	1	2	391	8,611
	Natham ..	52	287	4	11	354	
	Aiyalur ..	50	206	..	2	258	
	Kodaikanal ..	22	182	3	14	221	
	Palni	27	77	..	3	107	
	Cumbum ..	36	215	..	5	256	
	Total ..	**236**	**1,306**	**8**	**37**	**1,587**	**8,611**
1927–28 ..	Sholavandan ..	76	480	2	4	562	9,369
	Natham ..	50	223	..	1	274	
	Aiyalur ..	31	160	1	2	194	
	Kodaikanal ..	30	162	4	24	220	
	Palni	19	118	..	2	139	
	Cumbum ..	31	188	1	3	223	
	Total ..	**237**	**1,331**	**8**	**36**	**1,612**	**9,369**
1928–29 ..	Sholavandan ..	58	327	1	1	389	7,605
	Natham ..	45	281	..	..	326	
	Aiyalur ..	31	116	1	2	150	
	Kodaikanal ..	19	204	2	14	239	
	Palni	16	106	1	2	125	
	Cumbum ..	30	139	..	5	174	
	Total ..	**199**	**1,173**	**5**	**26**	**1,403**	**7,605**
1929–30 ..	Sholavandan ..	28	220	..	8	256	11,090
	Natham ..	78	368	..	8	454	
	Aiyalur ..	25	114	..	7	146	
	Kodaikanal ..	7	149	1	4	161	
	Palni	23	134	..	2	159	
	Cumbum ..	14	257	2	2	275	
	Total ..	**175**	**1,242**	**3**	**31**	**1,451**	**11,090**
1930–31 ..	Sholavandan ..	34	259	1	3	297	8,538
	Natham ..	72	364	..	5	441	
	Aiyalur ..	36	135	..	10	181	
	Kodaikanal ..	15	133	3	8	159	
	Palni	10	100	1	6	117	
	Cumbum ..	31	208	..	5	244	
	Total ..	**198**	**1,199**	**5**	**37**	**1,439**	**8,538**
1931–32 ..	Sholavandan ..	28	302	1	17	348	6,289
	Natham ..	57	384	..	4	445	
	Aiyalur ..	40	159	..	6	205	
	Kodaikanal ..	8	126	3	6	143	
	Palani ..	12	120	..	3	135	
	Cumbum ..	29	195	2	10	236	
	Total ..	**174**	**1,286**	**6**	**46**	**1,512**	**6,289**

Year.	Range.	Number of offences detected. Illicit grazing.	Illicit felling.	Incendiarism.	Miscellaneous.	Total.	Compounding fees collected.
							RS.
1932–33 ..	Sholavandan ..	35	296	1	3	335	9,129
	Natham ..	70	376	..	6	452	
	Aiyalur ..	22	207	..	..	229	
	Kodaikanal ..	22	173	..	9	204	
	Palni	7	127	..	2	136	
	Cumbum ..	45	265	4	34	348	
	Total ..	**201**	**1,444**	**5**	**54**	**1,704**	**9,129**
1933–34 ..	Sholavandan ..	39	394	2	..	435	9,488
	Natham ..	72	509	..	8	589	
	Aiyalur ..	21	192	..	4	217	
	Kodaikanal ..	18	188	3	8	217	
	Palni	17	136	..	4	157	
	Cumbum ..	41	264	4	27	336	
	Total ..	**208**	**1,683**	**9**	**51**	**1,951**	**9,488**

78. *Weeds.*—When stockmaps were prepared by Mr. C. C. Wilson in 1915 considerable areas were shown as invaded by the "prickly pear" (*Opuntia dillenii*) spreading inwards from the reserve boundary. The pear has now all but disappeared on account of destruction by the Cochineal insect. A fresh regeneration of the pear which appears to be more immune to the Cochineal than its ancester is, however, appearing in places.

It is too soon to predict what may happen to this new generation, but the chances are against its ultimate survival.

The pear was not an unmixed evil, however, as it helped to cover open ground. Also, on the humus resulting from the decayed pear, young regeneration of useful species, such as *Albizzia amara*, *Acacia latronum* and *Chloroxylon swietenia*, has appeared and is thriving.

The weed, *Acalypha fruticosa*, usually infests the lower slopes of fuel series, but is not very injurious as it is eaten by grazing cattle to some extent and this helps to keep it down. The thorny climbers, *Acacia intsia*, *Pterolobium indicum* and *Zizyphus oenoplia*, cause considerable suppression of young coppice shoots of useful species in comparatively moist localities.

The most troublesome weed, however, is a shrub belonging to the *Acanthaceae*, identified by the Forest Botanist as *Barleria acuminata* (Karun kurinji). It forms heavy thickets over large areas of fuel coupes rendering natural regeneration difficult. Also it is reported to flower every seventh year, when it dies gregariously over extensive areas and increases the danger from fire. It flowered in Natham and Aiyalur ranges between 1924 and 1926. It flowered again and died in 1933, over large areas in the Palni and Natham ranges. Efforts to induce the people to cut and remove this weed, free of charge, before the seed had set, did not meet with much success. It is the staple food of cattle and horses in the plantain gardens of the Lower Palnis. There is usually a bumper collection of honey when this shrub flowers gregariously.

The Vellakurinji (*Stenosiphonium russellianum*) is less gregarious in habit and flowers annually : It appears to be no more injurious than other common weeds.

The "Elephant grass," (Bothai) *Imperatum arundinaceum*, increases the intensity of fires on the Suruli plateau and on the Kumli ghat and kills out the regeneration of useful species like teak, *Pterocarpus marsupium*, and *Terminalia paniculata*.

Lantana is not usually prevalent except in moist localities in the Cumbum Valley and in the neighbourhood of abandoned plantations in the Palni hills. It forms impenetrable masses in such places and retards natural regenartion from seed.

79. *Cattle.*—Grazing cattle trample on young regeneration and expose the sub-soil where the soil is shallow and harden the soil where it is deep.

80. *Bison.*—On the Alagar hills, Sirumalais, and Karandamalais small herds of bison roam about which are a source of annoyance and loss to the agriculturists as they often damage their field crops. That they are potential dangers to 'rab' regeneration in our fuel coupes is apparent from the fact that they paid attention to almost every patch dibbled in 1932 in coupe XII of the Kanavaipatti series, on the slopes of the Karandamalais. They were also responsible for damage done to some young bamboos put out on the Karandamalais in 1933, and to teak stumps planted in 1934 in the Alagarhills.

81. *Sambhur.*—Sambhur nibble away the growing points of seedlings of *Acacia decurrens* and *Acacia dealbata* raised as firebelts round the sholas of the Upper Palnis. Their activities have also been noticed in fuel coupes in the Palni range, among 'rab' regeneration.

82. *Elephants.*—The serious damage done by wild elephants to the teak plantations at Vannathiparai is, perhaps, unparalleled in the annals of any teak plantations in South India. The plantations of 1920–1922 have been systematically visited by elephants every year and every teak plant has been broken down without exception. The elephants appear to be fond of the bark as they have also paid some attention to the bark of the grown up trees in the 1870 plantation. Curiously enough, *Dalbergia latifolia*, *Pterocarpus marsupium* and other valuable species appear to be perfectly immune to this damage.

Similar damage has been caused to naturally grown teak poles in the Kudiraiyar valley of the Palni range, another locality in the division systematically haunted by elephants.

The damage to teak is so intense that no plantation of this species can be attempted in localities frequented by elephants unless it can be effectively protected against them. Two methods of securing this have been prescribed in paragraph 480 of Chapter III of Part II, as experimental measures.

83. *Insects.*—The sal heartwood borer, *Hoplocerambyx spinicornis*, has been noticed on *Shorea talura* but not on an epidemic scale.

84. The growth of *Melia indica* is much hampered by the drying up of leading shoots caused almost every year by a virus disease not yet fully understood.

SECTION 3.—THE FAUNA.

85. The fuel forests of the division in the Sholavandan, Natham and Aiyalur ranges harbour little else than the wild pig, mousedeer and hare, with the exception of some bears, in places. In the isolated hills of the Karandamalais and on the Alagarmalais, however, where there are perennial streams, small herds of bison are found. They have been known to die of diseases common to cattle since they often visit the neighbouring fields to feed on agricultural crops.

86. On the Palni hills, which adjoin the vast forest tracts of the Travancore State, bison and sambhur roam about in considerable numbers. Tiger, panther and bear are met with occasionally but are nowhere common. The rocky precipices which bound the Upper Palni plateau on its south are the home of the ibex. The Kudiraiyar reserve, adjoining the Manjampatti forests, has ideal grazing grounds for bison, sambhur and elephants, all of which appear to be common.

87. The Murugamalais, near Periyakulam, among other neighbouring hills, harbour bears and peacocks.

88. In the extreme south of the Cumbum valley, elephant and bison may be frequently met with. In fact, the Vannathiparai and Suranganar valleys, quite as much as the Kudiraiyar valley, appear to be the home of wild elephants. Herds of 30 to 40 have been reported. In December 1933, fourteen elephants were found dead one morning in a field of "Varagu" (a species of millet) which adjoins our reserved forest near Vannathiparai bungalow. On investigation it was concluded that the death was caused by the presence of hydrocyanic acid in the field crop (Varagu) which has been known to cause a comatose condition in human beings, and even death, if the dose be a sufficiently large one. Tamarind is considered to be an antidote and it was reported that one or two elephants found in a prostrated but still living condition among the 14 dead ones, were given tamarind, upon which they recovered and staggered away into the forest ! A baby elephant belonging to the heard was caught but survived only for a few days.

89. The streams on the Upper Palni plateau appear to be suitable for trout. Some "rainbow trout" have been introduced in 1933–34 under the activities of the Palni Game Association. They are reported to be thriving.

90. The lac insect *Laccifera lacca* was introduced, in 1930, on *Schleichera trijuga* growing in the Vannathiparai valley. The climatic conditions in the valley appear to be favourable to this species of lac insect as it has thriven well and has been producing good crops of lac so far.

A detailed life-history of this insect together with the life histories of its predators will be found in Appendix VIII to this Working Plan.

CHAPTER III.—UTILIZATION OF THE PRODUCE.

SECTION 1.—AGRICULTURAL CUSTOMS AND WANTS OF THE POPULATION.

91. Agriculture is the primary occupation of the major part of the population in the plains. Considerable areas in the Periyakulam, Madura and Melur taluks are cultivated with irrigated crops (paddy and sugarcane, mostly) under the Periyar channel and other

irrigation works of a minor kind. Irrigation under wells is well developed in the Palni and Dindigul taluks, the latter being noted for its tobacco. In parts of Ayyalur range the people are in the habit of raising dry food-crops even on the tops of the several hills dotted about in the unreserves.

92. On the hills of the Lower Palnis there are vast areas under plantains and coffee outside the reserves : oranges and limes are also grown here. Some cardamom (*Elettaria cardamomum*) is grown outside the reserved forests, but the major part of this valuable produce is raised under sholas (evergreen forests) inside our reserves, on areas leased out for the purpose.

The villages on the Upper Palni plateau raise wheat, paddy and garlic (among other crops), in fields cut into the hillside in step formation, and irrigated by an ingenious system of channels cut approximately along the contours for long distances from the sources.

93. The ryots need agricultural implements, firewood for domestic consumption, leaf manure for wet cultivation, and timber and bamboos for house construction and general domestic use. Grazing grounds for cattle are, of course, necessary.

94. *Agricultural implements.*—Agricultural implements are mainly obtained from trees growing on patta lands or in adjoining unreserves and zamindari forests, the species most favoured being *Acacia ferruginea*, *Melia indica*, *Albizzia amara*, *Acacia planifrons* and *Acacia leucophlœa* : from tank beds *Acacia arabica* is taken for this purpose. There is a certain amount of theft on this account from the reserves where unreserves and zamindaris are not at hand (e.g., in the neighbourhood of the Alagar hills and Karandamalais), but not to a serious extent, except in the Cumbum valley. In this latter valley dry land is cultivated intensively on account of its favourable situation, so that unreserves are negligible : and it does not pay to grow timber on patta land. There is, therefore, a considerable demand for timber which is habitually being met by illicit fellings. Teak, *Pterocarpus marsupium*, *Dalbergia latifolia*, *Shorea talura* and *Albizza lebbek* are usually removed.

95. *Firewood.*—Fuel collected from unreserves, patta lands, and zamindari forests and faggot wood from fuel coupes, generally supplement the stalks of dry crops and the cowdung cakes largely used for domestic purposes. Where demand exists fuel coupe contractors issue head-load chits for the removal of faggot wood.

Most of the fuel coupes in Sholavandan, Natham and Ayyalur ranges supply the extensive fuel market at Madura, but since Madura takes billet-wood largely, there is sufficient small fuel left over for neighbouring villages. In these three ranges there are 55 fuel felling series, so that about 50 coupes are under felling every year, normally.

The fuel coupes in Kodaikanal and Cumbum ranges supply local demands entirely none of this fuel reaching Madura. There are 13 fuel felling series in these two ranges so that about 13 coupes are being felled every year to meet local demands.

In the Palni range the local demand is usually met from zamindari forests. There are two fuel series working, one of which supplies the Madura market. More fuel series will be prescribed in this plan to meet local demand.

In fact, the district is so well served in the matter of fuel that very little accessible area remains to be included in one fuel series or another.

In spite of this, illicit cutting for fuel is common in localities within reach of large centres of consumption, like Madura, Dindigul, Periyakulam, Cumbum, Usilampatti, Eriodu and other towns. Habitual thieves find their livelihood by selling stolen head-loads of fuel in such places. The Puthanatham reserved forest in Ayyalur range is subject to considerable illicit removal of fuel by the villagers of Puthanatham which adjoins it. It has been suggested that they have no other areas within a reasonable distance to supply their indispensable needs.

The villages in the Lower Palnis obtain their fuel from their gardens. In the Upper Palnis, however, scarcity of fuel is being increasingly felt with the gradual disappearance of sholas from unreserved land : illicit removals of dry fuel from reserved sholas have been noticed.

A species of *Strobilanthes* grows gregariously over all the grass lands on the Upper Palnis. It flowers and dies gregariously once in 12 years. The supply of dead *Strobilanthes* which results, usually meets the fuel requirements of the villages for a period of 3 to 4 years. There was a gregarious flowering in 1934, so that the present supply is likely to last till the end of 1939.

Private plantations of wattle and *Eucalyptus* are already in evidence at Poombarai, Kukkal, Kavunji and Mannavanur to meet the demand for firewood.

96. *Leaf-manure.*—With the closure of all reserves in 1912 to removals of manure leaf, the ryots have, to a very large extent, learnt to grow suitable shrubs in their dry land. Signs of illicit removal are, however, noticeable on the eastern slopes of the Alagar hills, in the Kiluvamalai and Waguthumalai reserves and elsewhere. These adjoin extensive wet lands under the Periyar channel.

97. *Timber.*—There is very little large timber in the reserves of the division except on the comparatively inaccessible slopes of the Palni hills (Kodaikanal and Palni ranges) in the Vannathiparai valley, on the Surlipatti plateau (Cumbum range) and a small quantity in the valleys of the Karandamalais (Natham range). *Melia indica* and the mango, grown on private land, are the poor man's timber in the plains. There is some illicit removal of small timber from the reserves, mainly teak, *Pterocarpus marsupium*, *Shorea talura* and *Stereospermum chelonoides*, but this is not extensive except in the forests of the Cumbum range. This range contains extensive areas under wet and dry crops (they enjoy the very first quota of Periyar water) and a comparatively prosperous population which naturally demands timber. The "Kallars," a community with an instinct for theft, which has consequently been placed under the Criminal Tribes Act, form a large proportion of the population. In the absence of legitimate means for meeting this real and necessary demand, the Kallars supply it illicitly, mainly from our reserves, and partly from the adjoining Travancore forests.

The villagers in the Lower Palnis use *Michelia champaca*, *Acrocarpus fraxinifolius*, *Cedrela toona* and *Pterocarpus marsupium*, all of which grow among their coffee or plantain gardens or in the adjoining unreserves.

In the Upper Palnis the majority of the houses have walls of wattle and daub, the reeds for which are obtained from the various scattered sholas on the plateau. The few rich get their *Eucalyptus globulus* from Kodaikanal.

98. *Bamboos.*—The bamboo is of great general utility to the villagers as well as to the townsmen and is in considerable demand. The bamboos of the division occur in localities difficult of economic access from large centres of consumption, such as, Madura and Dindigul. Local village demand is met in Cumbum, Periyakulam and Palni taluks through extraction by head-loads. The other taluks depend to a small extent on clumps grown by private persons on the banks of streams, which are supplemented by imports from Malabar, Mettupalaiyam, Salem and other places.

If cart tracks be constructed, some of the well stocked bamboo areas of the Palni range can be profitably worked for the Madura and Dindigul markets.

99. *Grazing and grass.*—Out of a total area of 396,841 acres of reserved forest, only 30,000 acres are permanently closed to grazing, the balance being open. Of the open areas, fuel coupes are temporarily closed for a period of ten years after felling. There appears to be no difficulty for grazing grounds, therefore, generally speaking. But the absence of fodder grass in areas worked for fuel and the thorny bushes which cover much of the ground soon after fellings have taken place, reduce the utility of fuel forests for grazing purposes. Cattle usually have to feed on *Acalypha fruticosa* and *Barleria acuminata* in such localities, consequently.

Owing to the intensive cultivation practised in the Cumbum valley, cattle have to resort to the forests more freely in that range than in most others in the division, and are consequently being penned in the neighbouring Travancore forests. The reserves are often too far away from the villages for cattle to return home the same day. Representations were made to the Working Plans Officer by some of the ryots for the reopening of certain old pens in the reserves which remain closed now. Such steps as it is possible to take in this direction are detailed in paragraph 826 in part II.

100. *Thatch grass.*—There is a considerable demand from the reserved forests for grass for thatching purposes. This produce is now being removed under cover of permits issued by the lessees of minor produce, in whose leases it is included.

101. *Brakepoles.*—Bullock carts going down the Kodaikanal Ghaut road with hill-produce (coffee and plantains) require brakepoles to keep their velocity in check. About a thousand poles are now being supplied every year from the adjacent reserves: this want must continue to be met.

102. *Land for growing plantains and coffee.*—There appears to be an unlimited demand for land on the hills of the Lower Palnis for the cultivation of plantains, with or without coffee. Large areas surrounded by reserved forests were left as enclosures at the time of forest settlement to meet the demand of the existing villages, but the handsome return that these crops yield attracts applications from capitalists from the plains.

103. *Kapok.*—The floss from the fruits of *Eriodendron anfractuosum* commercially known as 'Kapok', is in considerable demand for the stuffing of mattresses and pillows. Small plantations of this species have been raised on private land where water is not scarce, e.g., on stream-banks in the Palni, Cumbum and Kodaikanal ranges. A plantation, on an experimental scale, is being prescribed in Chapter VII of Part II, for the production of this minor produce.

104. *Sholas (Evergreen forests) for growing cardamoms.*—Evergreen forests at elevations between 3,000′ and 5,000′ are in considerable demand for the cultivation of cardamoms, (*Elettaria cardamomum*) a crop which yields an attractive profit. Most of the area suitable for the purpose has been leased out already.

105. *Panchayats.*—The following reserves and unreserves are managed by panchayats who are permitted to exploit them for firewood, grazing, minor produce and leaf manure :—

Areas under panchayats.

Reserve or demarcated unreserve.	Area in acres.	Range in which situated.
Reserves.		
Kodimangalam A and B	2,850	Sholavandan.
Vikramangalam (portion)	465	Do.
Nallathevanpatti	3,921	Do.
Kadavakurichi	2,253	Do.
Senkatampatti	1,804	Do.
Vattilaipatti	874	Do.
Mannadimangalam	1,495	Do.
Usilampatti	198	Nattam.
Rengamalai-Vandamalai	1,708	Ayyalur.
Rengamalai	1,018	Do.
Karumalai	2,042	Do.
Mamankurichi	1,005	Do.
Maramareddipalayam	783	Do.
Nedingur	634	Do.
Edumalai	1,352	Do.
Omandur	713	Do.
Vellakalpatty	386	Do.
Vellaikaradu	441	Cumbum.
Perumalkoilkaradu	444	Kodaikanal.
Valkaradu	710	Do.
Total ..	25,096	
Unreserves.		
Sengurichi, Pudur, Velayudapalayam villages	1,774	Ayyalur.
Gollapatti (S. No. 625-1)	291	Do.
Pallapatti, Silambakonepatti	1,360	Nattam.
Mundagamalai	553	Do.
Pudur	267	Do.
Panniam (S. No. 134)	202	Sholavandan.
Thadayampatti	987	Do.
Total ..	5,434	
Grand total ..	30,530	or 47·7 sq. miles.

SECTION 2.—MARKETS AND MARKETABLE PRODUCTS.

106. *Timber.*—Large quantities of teak, *Dalbergia latifolia*, *Terminalia tomentosa*, *Terminalia paniculata* and *Adina cordifolia*, of all sizes, are imported into Madura, Dindigul and Palni from the West Coast (including Travancore and Cochin States) and from the Pollachi depot; teak is also imported from Burma. Squared logs are preferred to round ones. *Dalbergia latifolia* is utilized in Madura for making elaborately carved tables with legs represented by elephant heads—an art characteristic of the place.

Other imported timber is usually in the shape of "Kolmarams", that is to say scantlings 16′ × 6″ × 4″, used mainly for shafts of bullock carts and chattams, which are 8′ × 6″ × 3″, and are used for cart frames. The species most commonly used are

Xylia xylocarpa, *Terminalia tomentosa*, *Terminalia paniculata*, *Dichopsis elliptica*, *Calophyllum elatum*, *Dipterocarpus sp.*, *Vateria indica*, *Aglaia sp.*, *Amoora sp.*, *Acrocarpus fraxinifolius*, *Lagerstroemia lanceolata* and *Hardwickia pinnata*. Most of this timber comes from the West Coast.

Boards and planks of *Mangifera indica*, *Melia indica*, *Cedrela toona* and *Adina cordifolia* find a ready market in all the towns mentioned above.

The two cigar factories at Dindigul together consume some 4,500 c.ft. of *Cedrela toona* every year, for making cigar boxes. Messrs. Spencer and Company, who consume the major part of this quantity, obtain their supply from the West Coast. The unreserves and pattas of the Lower Palnis supply the other factory, which is satisfied with the inferior quality of the local timber. The local timber (Lower Palnis) is riddled with insectbores and is reported to be lacking in the required aroma.

The small quantity of inferior timber which can be made available from the Cumbum range will be readily consumed locally at *Melgudalur*, *Cumbum*, *Uthamapalayam* and *Theni*.

107. *Firewood—The Madura Fuel Market.*—The fuel requirements of the City of Madura —the second city in the Presidency—with a population of about 1,82,000, has frequently been the cause of anxious concern to the forest department. In the year 1913 it was estimated by the District Forest Officer (Mr. J. S. Scot) that Madura required about 60,000 tons of firewood per annum. The price of firewood in the city rose to about Rs. 30 per ton and memorials to Government resulted in the appointment of a Working Plans Officer to devise ways and means for increasing the output of fuel into Madura from reserved forests. Mr. C. C. Wilson, the Working Plans Officer, estimated in 1915–16 that about 30,000 tons of fuel were required for domestic consumption, and about an equal quantity for the spinning mills and the dyeing vats of this growing industrial centre. Between 1922 and 1929 the spinning mills gave up producing power by burning firewood in favour of coal or crude oil. This, combined with the more general use of synthetic dyes resulting from the industrial activity and fall in prices following the close of the Great War, must have resulted in a very considerable reduction in the consumption of firewood in Madura. In 1929, the demand must therefore have fallen to some 33,000 tons per annum.

108. In order to ascertain the current annual consumption of firewood in Madura, the prevailing system of import and sale of this material was investigated. It was ascertained that almost all fuel sold in Madura, arriving both by road and by rail, was sold either from depots maintained by fuel contractors or through recognized commission agents. The quantity that was directly hawked about the streets was found to be only a small proportion of the total sales. The figures collected showed that about 3,500 tons passed through the hands of the dealers every month, which works out to about 42,000 tons per year.

As a check on this figure, imports by road were ascertained separately and those by rail were obtained from the South Indian Railway: their total worked out to about 3,370 tons per month—a figure sufficiently close to 3,500 to warrant its reliability.

109. The following table exhibits the sources of this annual supply :—

Number and source.		Quantity in tons per year.	Remarks.
1	Reserves of Ayyalur range	10,500	Rail figures.
2	Doddappanaikanur zamin	1,600	Contractor's account.
3	Reserves of Nattam and Sholavandan ranges.	14,000	Based on indicator areas.
4	Reserves of Palni range	600	Rail figures.
5	Tinnevelly reserves and zamins	750	Do.
6	Ramnad zamindari	500	Do.
7	Pudukotah State	1,400	Do.
8	Marungapuri zamindari	500	Figure from estate manager.
9	Sivaganga zamin—Usil forests	6,000	Half of 1,200 acres sold has been actually felled. Estimated out-turn.
10	Do. Babul from tank beds	5,000	Estimate.
11	Patta fuel—direct sales	2,700	Do.
	Total ..	43,550	

110. The permanency of the different sources and the sustained annual supply each is capable of yielding may now be usefully examined.

(*a*) *Reserves of Madura division.*—The annual aggregate felling area of the fuel series supplying Madura is 4,176 acres. Against the Working Plan estimate of an average

of five tons per acre, the average based on indicator areas has been eight tons ; the average annual yield may therefore be reasonably estimated at 6 tons per acre. The annual yield from the reserves supplying Madura may therefore be expected to be 25,056 or, say, 25,000 tons, on the average. This supply will be a sustained one.

(*b*) *The Sivaganga zamindari.*—The Sivaganga zamindari has some 33,000 acres of fuel forests of the *Albizzia amara* type, lying within economic reach of Madura by road or rail. On a 30-year rotation and with a stand of 10 tons per acre (the stand is overmature, not having been felled in the past), a sustained annual yield of about 10,000 tons may be expected for the next 30 years. About 5,000 tons of *Acacia arabica* fuel may also be expected every year from the large number of tank beds in the zamindari.

(*c*) *Marungapuri zamindari.*—This zamindari adjoins Natham and Ayyalur ranges. A trained ranger is in charge of the forests. The estate manager estimates a sustained output of 500 tons into Madura.

(*d*) *Pudukotah.*—The Administrator of this State estimates 600 tons as the sustained contribution of this State to the Madura market.

(*e*) *Tinnevelly.*—The Working Plans Officer, Tinnevelly, states that 500 tons may be available from the Srivilliputtur reserves every year.

(*f*) *The Doddappanaikanur zamindari.*—The zamindari of Doddappanaikanur may be expected to supply a sustained yield of 1,000 tons every year.

(*g*) *The Ramnad zamindari.*—The zamindari of Ramnad will continue to supply about 1,500 tons of *Acacia arabica* from tank beds every year, and may supply up to 500 tons of *Acacia planifrons* from the sea coast.

(*h*) *Patta fuel.*—Patta fuel (tamarind and *Melia indica*) may be expected to give about 3,000 tons per year.

111. The total sustained yield will therefore be as follows :—

Number and source.		Maximum annual sustained yield in tons.
1 Reserves of Natham, Ayyalur and Sholavandan	.. ..	25,000
2 Sivanganga zamindari	(*Albizzia amara*)	10,000
	(*Acacia arabica*)	5,000
3 Marungapuri zamindari	.. ..	500
4 Pudukotah	.. ..	600
5 Tinnevelly reserves	.. ..	500
6 Doddappanaikanur zamindari	.. ..	1,000
7 Ramnad	.. ..	1,000
8 Patta lands	.. ..	3,000

giving a total of 46,600 tons per annum.

112. Since the annual requirements of Madura now are not more than about 43,000 tons there appears to be sufficient fuel available to prevent the market rate in Madura from rising to prices incommensurate with the general price level of other commodities. If, however, the Sivaganga zamindari reverts to its old policy of not allowing fellings in their *Albizzia amara* forests, the supply will not be far in excess of the demand and there should then be a desirable improvement in the prices we obtain for our fuel coupes.

It is understood also that the railways are offering a reduced rate of As. 3–6 per maund for *Casuarina* fuel from Porto Novo, Alapakkam and Cuddalore on the East Coast, to Madura. The higher prices that consumers are usually willing to pay for this fuel opens up possibilities of other sources of sustained supply to Madura.

It has also been observed that private parties are raising *Casuarina* plantations in some parts of the division, particularly in the Ayyalur and Sholavandan ranges. This will certainly supplement the other sources in course of time.

113. *Bamboos.*—There is an extensive demand for bamboos in Madura, Dindigul, Palni and other places. This is at present met mainly by imports from the West Coast, Salem, Vellore and other places.

The bamboos in the Cumbum and Kodaikanal ranges can meet only the local demand. In the Palni range, however, there is a considerable quantity of bamboo in the Kudiraiyar, Olianuthu, Siruvathukad and Vennilai blocks of the Northern Slopes Reserves, which can supply a part of the Madura demand if transport facilities be provided. Suitable prescriptions will be included in Part II to provide these facilities.

114. *Dyestuffs.*—Madura has been long famous for the dyeing of cotton and silk for which the leaves of *Memecylon edule* (Kayan) were in great demand. Aniline dyes have

largely displaced the old vegetable ones, but considerable demand for *Kayan* leaves still exists. This produce is being sold separately for Natham and Ayyalur ranges. The lease amounts for the last ten years were—

Year.	Lease amounts for Natham range.	Lease amounts for Ayyalur range.
	RS.	RS.
1925–26	2,000	515
1926–27	1,505	315
1927–28	1,610	502
1928–29	3,705	405
1929–30	3,710	390
1930–31	4,785	400
1931–32	2,050	57
1932–33	1,000	..
1933–34	530	40
1934–35	400	..

115. *Tanstuffs.*—Dindigul is the centre of an extensive tanning industry which consumes among other materials large quantities of the bark of *Cassia auriculata* (Avarai pattai) and of myrobolans, the fruit of *Terminalia chebula*. Enquiries at the local tanneries show that about 300 tons of myrabolans and 5,000 tons of the bark of *Cassia auriculata* are being consumed every year at Dindigul, on an average. Against this the division produces about 30 tons of myrabolans and 300 tons of *Cassia auriculata*.

The local myrabolans have a high reputation for quality, and are valued at Rs. 90 per ton against Rs. 50 quoted for poorer qualities from outside. There is little doubt that the local market will easily absorb any increase in the output of this produce from the division, with a good financial return.

The bark of the root of *Ventilago madraspatana*, the bark of *Cassia fistula*, the leaves of *Cassia montana* (Ponnavaram) and the bark of *Acacia sp.* (Wattle) are also used, to a small extent.

Myrabolans are being leased out separately every year, the units being the reserves and unreserves of—

(1) Kodaikanal and Palni ranges.

(2) Cumbum range.

(3) Sholavandan, Ayyalur and Natham ranges.

The Sirumalais, Karandamalais and Thoppaswami malai reserve forests are at present, excluded from the lease, to reduce the risk of fire.

116. *Other minor forest produce.*—The subjoined list gives the more important varieties of minor forest produce occuring in the division, for which there is normally a demand :—

Serial number.	English and botanical names.	Tamil name.	Remarks.
1	Avaram bark (*Cassia auriculata*)	Avarampattai	For tanning.
2	Myrabolans, chebulic (*Terminalia chebula*).	Kadukkai	Do.
3	Myrabolans, beleric (*Terminalia belerica*).	Tanikkai	For medicinal pusposes.
4	Myrabolans, emblic (*Phyllanthus emblica*).	Nellikkayi	Fruits—pickled.
5	Tamarind (*Tamarindus indica*)	Puli	Fruits used for culinary purposes.
6	*Acacia concinna*	Seeyakayi	Pod used as soap substitute.
7	Mangoes	Mangai	Fruits—pickled.
8	*Carissa carrandas*	Kilakkai	Do.
9	*Sapindus emarginata* (Soapnut)	Poondhikottai	Fruits—soap substitute.
10	*Solanum pubescens*	Sundakkai	Fruits—pickled.
11	Honey	Then	Bumper crop when *Barleria* flowers gregariously once in seven years.
12	Wax	Mezhuku	Do.
13	Cane (*Calamus sp.*)	Pirambu	Stem for furniture and boxes.
14	Plantain leaves	Vazhai elai	Leaves—food plates.
15	*Helicteres* fibre	Valamburi nar	Fibre—used as country twine.
16	Date leaves	Eecham nar	Leaves—broomsticks.
17	Date fruits	Eecha pazham	Fruits—edible.
18	*Gymnema montana*	Magali	Roots—pickled.
19	Custard apple	Seetha pazham	Fruits—edible.
20	*Zizyphus jujuba* fruits	Elandapalam	Do.
21	Sarsaparilla (*Hemidesmus indicus*)	Nannari ver	Root—medicinal.
22	*Ochlandra* species	Eethai	Stem and leaves—basket manufacture and house construction.

Serial number.	English and botanical names.	Tamil name.	Remarks.
23	Ginger	Inji	Root—pickled—medicine.
24	*Hedyotis umbellata*	Saya ilai	Leaves—dyeing.
25	Thatching grass (*Imperatum arundinaceum*).	Bothaipul	Grass—thatching.
26	Dammar	Kungilium	Gum—incense.
27	Korai grass	Koraipul	Grass—mat manufacture.
28	Grass	Kamachipul	Do. thatching.
29	Grass	Pulamar	Stem—basket manufacture.
30	Grass	Sembul	Grass—thatching.
31	Grass	Kattukodi	Stem—hitching and bonding of roofs of shed.
32	*Acacia pinnata*	Indampattai	Bark fibre—used as soap substitute.
33		Marul	Leaf—fibre.
34		Kannikodi	Stem—basket making.
35	*Pongamia* seeds	Pungam kottai	Seed—oil.
36	Cardamoms	Elakkai	Fruits—spice from evicted leases.
37	Coffee	Kappi	Seed—from evicted leases.
38	*Memecylon edule*	Kayan	Leaf—dyeing.
39	*Dioscorea sp.*	Vallikodi	Root—edible.
40	*Bambax malabaricum* floss	Elavankai	Floss—stuffing mattresses.

Tamarind trees occur in considerable numbers in the Fuel Working Circle and are reserved when fuel coupes are sold. If the lease of tamarind fruits be separated from that of other minor forest produce better prices are likely to be obtained. Other produce of minor importance are included in the list annexed to the annual leases.

117. *Lac and lac products.*—Lac may be disposed of as scraped lac, seed lac and dust lac; lac dye, which is a bye-product, is also saleable.

The chief market for lac in India is Calcutta which is practically the world's clearing house for all lac products. Seed lac of good quality can always be easily sold at Calcutta up to the maximum quantity we shall be able to produce at Vannathiparai. And as our cost of production is about Rs. 10 a maund, we shall make a profit even if prices should go down to Rs. 20 a maund, the lowest on record, or still lower.

There also exists a local demand for lac products in South India. Large quantities of stick lac are used on the West Coast in the preparation of medicated oils; sealing wax, wood polish and bangles consume an appreciable quantity of lac dust and seed lac; and the dye is in demand for dyeing silk at Berhampur, Kumbakonam and other places.

Kusum lac always fetches a price of some Rs. 5 per maund more than lac grown on other hosts.

SECTION 3.—LINES OF EXPORT.

118. On the whole the division is well served by a system of railways and roads.

119. *Railways.*—The metre gauge section of the South Indian Railway traverses the division from east to west, passing from Trichinopoloy through Manapparai, Ayyalur, Dindigul and Palni, to Pollachi and the West Coast. A southern line runs from Dindigul to Madura and thence to Dhanushkodi on the East Coast and to Trivandrum on the West Coast. Madura is connected by a branch line to Bodinayakkanur at the foot of the Western Ghats: an extension of this to Gudalur (Cumbum range) is likely to materialize in the near future, when the Cumbum forests will become more easily accessible to Madura. The Manamadura-Trichinopoly chord line has brought Madura nearer to the Ramnad district and to the Pudukotta State.

The railways are used extensively for the transport of fuel to the Madura market. Practically the whole of the fuel output of Aiyalur range is transported by rail to Madura from stations between Manapparai and Dindigul. Fuel from the Virupakshi series of Palni range is booked to Madura from Oddanchatram. Part of the output from Sholavandan and Natham ranges also goes by rail to Madura from stations on the Dindigul-Madura and Madura-Bodinayakkanur lines. Fuel from the Ramnad district and from Pudukotah State arrives by rail, and occasionally *Casuarina* fuel from the East Coast.

120. *Trunk roads.*—A trunk road closely follows the railway through Trichinopoly, Manapparai and Dindigul towards Pollachi on the west. Another follows the railway line from Dindigul to Madura and thence southwards towards Tinnevelly while a third runs parallel to the Madura-Bodinayakkanur section. Roads from Dindigul and Kodaikanal Road railway station pass through Periyakulam to Theni on the west. From Theni a road runs southwards into the Cumbum Valley to the Periyar lake, and thence into the State of Travancore. A metalled road from Kodaikanal Road railway station leads to the hill station of Kodaikanal, the ghat section of which passes through reserves for the most part.

Second-class trunk roads run from Ayyalur and Dindigul towards Karur, from Oddanchatram and Palni to Dharapuram, and from Madura into the Ramnad district.

121. *Other district roads.*—Minor roads that feed the trunk roads are more directly concerned with the transport of forest produce since they pass through localities nearer to the reserved forests.

Of these the most important are the road connecting Dindigul and Madura through Natham, the Natham-Kottamppatti-Manaparai road, and the road from Manapparai to Kulittalai, all of which are useful for the exploitation of the forests on the "Natham and Ayyalur hills." The sections connecting Madura with the Alagar temple and with Palamedu help to work the Alagar hills reserve and the Waguthumalai group.

122. Other useful roads are tabulated below :—

Serial number. (1)	Name of road. (2)	Authority maintaining the road. (3)	Area served. (4)
1	Usilampatti-Uthappanaikanur road	D.B.	Rajadani and Andipatty north reserves.
2	Uttappanaikanur-Rajadani road	F.D.	Do.
3	Andipatti-Palamedu road	F.D. and D.B.	Waguthumalai, Sirumalai and Sembatti reserves.
4	Sathiar valley road	F.D.	Sembatti, Sirumalai and Kachaikatti reserves.
5	Anjukulipatti-Valayapatti road	F.D. and D.B.	Sirumalai and Erukkalamalai reserves.
6	Dindigul-Sirumalai road	D.B.	Sirumalai, Sirumalai North-east, and part of Sirumalai North-west reserves.
7	Thanichayam-Alanganallur road	D.B.	Waguthumalai reserve.
8	Uthappanaikanur-Peranai road	D.B.	Vikramangalam reserve.
9	Periyakulam-Amburuvi road	D.B.	Amburuvi reserve.
10	Devadanapatti-Iruttar road	D.B.	Southern slopes and Murugamalai reserves.
11	Vattalakundu-Thummalapatti road	D.B.	Mankaradu reserve.
12	Periyakulam-Pambar road	D.B.	Southern slopes and Adukam reserves.
13	Cumbum-Kamayagoundanpatti cart-track.	D.B.	Cumbum Valley East reserve forest.
14	Vannathiparai road	F.D.	Vannathiparai, Kappuvamadi and Melgudalur reserves.
15	Uthamapalayam-Kombai road	D.B.	Kombai and Pannimuthukaradu reserves.
16	Uthamapalayam-Surulipatti road	D.B.	Cumbum Valley East reserve forest and the whole of Suruli plateau.
17	Vattalakundu-Ayyampalayam road	D.B.	Marudanadiar reserve.
18	Ayyampalayam-Tandigudi road	D.B.	Reserves of lower Palnis, Kodavanar, Pambukallar, Kokkuparai and Kallar reserve forest.
19	Oddanchatram-Vadakadu road	F.D. and D.B.,	Northern slopes reserves and Siruvatkad.
20	Virupakshi-Parapalar road	D.B.	Noerthren slopes reserves.
21	Palni-Velancombai pipe-line road	Palni Municipality.	P.V. Valley.
22	Ayyalur-Mungilkaradu road	F.D.	Mungilkaradu reserve forest.
23	Ayyalur-Senkurichi road	F.D. and D.B.	Pannamalai, Thannirkaradu, Mudimalai, Sundamalai and Shorimalai reserve forest.
24	Ayyalur-Sendurai road	F.D. and D.B.	Panjantangi reserve.
25	Sendurai-Pillayarnatham road	F.D. and D.B.	Kiluvadi, Panjanthangi and Pillayarnatham reserve forest.
26	Senkurichi-Vadamadura road	F.D.	Mudimalai and Pannamalai reserve.
27	Kovilur-Thoppaswamimalai road	F.D. and D.B.	Thoppaswamimalai reserve forest.
28	Kombai-Pillayarnatham road	F.D.	Pillayarnatham and Panjanthangi reserves.
29	Vayyampatti-Kadapichampatti road	F.D.	Karpur-Reddiapatti, Sorupam and Kumarikatti reserves.
30	Kalpatti-Pillayarnatham road	F.D.	Sorupam, Panjanthangi valley, Minnakaradu and Pillayarnatham reserve forests.
31	Ayyalur-Thoppaswamimalai South road.	F.D.	Thoppaswamimalai reserve forest.
32	Vayyampatti-Kadavur road	D.B.	Mogavanoor and Semmalai reserves.
33	Puthanatham-Marungapuri road	D.B.	Puthanatham reserve forest.
34	Kalpatti-Puthanatham cart-track	F.D.	Kumarikatti and Singakaradu, Sorupam and Karpurreddiapatti reserves.
35	Sengurichi-Kanavaipatti road	F.D. and D.B.	Karandamalai and Mudimalai reserves.
36	Kanavaipatti-Valayapatti road	F.D.	Erukkalamalai and Perumalai reserves.
37	Munnur-Vemburli road	F.D.	Alagar hills reserve forest.
38	Natham-Kuttupatti road	F.D. and D.B.	Methugamalai reserve forest.
39	Kuttupatti-Manakattur road	F.D. and D.B.	Karandamalai reserve forest.
40	Kuttupatti-Kosikurichi road	F.D. and D.B.	Chinnapattikaradu reserve forest.
41	Arukkampatti-Madura-Natham road	F.D.	Chembulimalai and Alagar Hills reserves.

Serial number.	Name of road.	Authority maintaining the road.	Area served.
(1)	(2)	(3)	(4)
42	Sendurai-Kodangipatty road	F.D. and D.B. ..	Kodangikuttu and Mudimalai reserves.
43	Sendurai-Manakattur road	F.D. and D.B. ..	Kodangikuttu reserve forest.
44	Kodangipatti-Songurichi road	F.D. and D.B. ..	Karandamalai and Mudimalai reserves.
45	Natham-Sirugudi road	D.B.	Pudagudimalai and Pulamalai.
46	Pottapatti road	D.B.	Vellimalai resrerve forest.
47	Kottapatti-Pusaripatti cart-track	F.D.	Viramalai reserve forest.

F.D. = (Forest Department). D.B. = (District Board).

SECTION 4.—METHODS OF EXPLOITATION AND THEIR COST.

123. *Timber*.—Departmental exploitation of timber prevailed in the Cumbum range up to 1928 after which year it was ordered to be stopped. The following rates were paid for exploitation and transport of logs :—

	RS.	A.	P.	
Felling charges	0	1	6	per c.ft.
Logging and rough squaring	0	1	6	,,
Dragging to cart-stand (average lead 3 miles) ..	0	2	0	,,
Carting to depot (average lead 6 miles)	0	2	0	,,
Total ..	0	7	0	

For scantlings sawn at stumpsite, the rates were as follows :—

	RS.	A.	P.	
Felling	0	1	6	per c.ft.
Sawing	0	12	0	,,
Transport by head-load to foot of hills, average lead 6 miles.	0	3	6	,,
Carting to depot, average lead 6 miles	0	2	0	,,
Total	1	3	0	

Conversion into spokes and felloes costs about As. 6 a cubic foot.

The rates paid for felling, rough squaring and sawing appear to be capable of considerable reduction, in view of the prevailing low cost of living.

The following rates are suggested as reasonable for future exploitation :—

	RS.	A.	P.
Logs—			
Felling and rough squaring..	0	2	6
Dragging	0	2	0
Cart-hire to depot	0	1	6
Total ..	0	6	0
Sawn scantlings—			
Felling	0	1	0
Sawing	0	10	0
To cart-stand	0	2	6
To depot	0	1	6
Total ..	0	15	0

Dead and wind-fallen trees are being collected departmentally in the Kodaikanal range, after conversion at stumpsite. The quantity collected every year is small, about 250 c.ft., and the cost of exploitation compares favourably with that quoted for the Cumbum range. This work has been stopped from 1934 as it is liable to abuse.

In 1932 some 50 dead and dying trees of teak, *Pterocarpus marsupium* and *Terminalia paniculata* were marked for felling and sold standing to a contractor. The sytem resulted in illicit fellings by the purchaser and was discontinued in consequence.

124. *Brakepoles.*—Trees suitable for the purpose are marked for felling. The marked trees are then felled departmentally, converted into brakepoles (5 feet long and 1 to 2 feet in girth) at the rate of one anna per pole, and delivered at the sale depot on the motor road to Kodaikanal. The sales are effected by a forester, at the rate of As. 4 a brakepole.

For the period 7th October 1935 to 6th October 1936, the lease for sale of brakepoles to the public has been granted to the keeper of a tea shop who has rented a small site at Thakkia at the 6th mile, 4th furlong, along the motor road to Kodaikanal. The shopkeeper pays an annual rent of Rs. 36 for the site of the shop and has agreed to purchase brakepoles from our coupe at As. 1–6 each (the lessee to cut the brakepole at his cost but under our supervision) and to sell them to the public at a rate not exceeding As. 3–6 each, always maintaining a minimum stock of 50 brakepoles. The shopkeeper has in addition paid a premium of Rs. 20 for the right to run a shop at the site in question.

125. *Firewood.*—All fuel coupes are being worked under contract agency.

In the Sholavandan, Ayyalur and Natham ranges, which supply the Madura market with fuel, the trees are felled, billetted and stacked by the felling coolies, who are paid at rates varying from Re. 1 to Rs. 2 for a stack of 80 cubic feet ($8' \times 4' \times 2\frac{1}{2}'$ or $10' \times 4' \times 2'$ or $9' \times 4' \times 2\frac{1}{4}'$).

A system of cart roads is usually built into the coupe by the contractor, the roads rising up the hillslope to about two-thirds of the height of the hill. The fuel billets are delivered at cartsite by sliding them down the hill slopes, the billets being brought to the slidehead by coolies. Where the slope is not continuous coolies carry the billets from dumps at the base of one slide to the head of the next. The earth slides are usually a couple of chains apart from one another.

The rate for sliding down the billets to cartheads varies from As. 8 to Re. 1–8–0 per ton depending on the lead.

Country carts deliver the fuel at the neighbouring railway station if the coupe contractor sells the fuel at Madura or purchase the fuel at the coupe for sale at Madura. Transport charges depend upon the lead to the railway station, but the fuel is weighed and loaded at the coupe and the charges are fixed per *ton* of load carried. The prevailing rates of transport for the different fuel series will be found in paragraph 550 in chapter IV of Part II of this plan.

Motor lorries are being used latterly, by the more enterprising contractors, for transport from coupes to rail heads.

A simple system of ropeway was used by an enterprising fuel contractor in the years 1933 and 1934 in some coupes of the Natham range to bring down the fuel billets to cartheads. The wire rope used was about half inch in diameter and was 1,000 feet long. At each end the rope was passed over a strong tripod made of stout poles, the top end of the rope being secured to a stump direct and the bottom end through a pulley and screw arrangement for regulating the tension of the rope. A number of small pulley blocks, about 4 inches in diameter, each with a hook at the bottom, could be slipped on to the rope : the bracket housing the axle of the pulley on one side could be opened for the purpose. These pulleys were made by local blacksmiths. Two loops of thin wire hung on the hook were used for loading the billets of firewood and the load struck against a heap of brushwood packed against the lower support and came to rest. The empty blocks were collected at the bottom and carried up by a coolie in batches of a dozen or more at a time for loading again. One or two such sections were used depending upon the elevation. The rope costs Rs. 120, the tightening gear about Rs. 150, and the pulleys a rupee each. The saving in labour was estimated by the contractor to vary from 25 per cent to 40 per cent depending on the nature of the country and the stand of fuel per acre.

This system may well be encouraged to the advantage of the hill sides.

In coupes which supply local requirements, as the majority of the felling series in the Cumbum, Kodaikanal and Palni ranges, the contractors pay coolies for felling and coppicing at rates varying from Rs. 5 to Rs. 15 per acre depending on density of stock. Purchasers and consumers billet the felled material at their own cost. This is gradually being replaced by the system of rates for stacked fuel as in the other felling series mentioned above.

Headload tickets are being issued in all coupes for faggotwood left over from felled trees: in fact this is the main method of extraction followed in coupes which meet the requirements of small towns, such as Theni, Uttamapalaiyam and Palni.

126. *Charcoal.*—Charcoal makers fell the trees themselves and deliver the manufactured charcoal at cartheads at As. 6 to As. 7 per bag of 56 lb.

127. *Bamboos.*—The bamboo contractors issue headload tickets to consumers and purchasers. The usual rates are as follows :—

Palni Range.

Rate.		Class of bamboos.
As. 2 per head-load	..	Kalas (Top ends) Savarikattai and Sattai kuchi.
As. 3 per head-load	..	Vari, Ettumulakattai, Arumulakattai, Pandaltharam and Dabbaikattu.
As. 4 per head-load	..	Sirumungil dabbai.

Cumbum Range.

As. 4 per head-load	..	Only *Bambusa* varais.
Rs. 5 per cart-load	..	

128. *Minor forest produce.*—The lessees who purchase the right to collect minor produce often sublet their rights over smaller units to other contractors, unofficially. Tamarind and honey are the usual produce thus sublet.

Lessees pay collection charges for the following kinds of minor produce at the rates approximately as shown against each :—

	RS.	A.	P.	
Gallnuts (*Terminalia chebula*)	0	1	0	Per Madras measure.
		to		
	0	1	6	
Honey	1	0	0	Do.
Seekay (*Acacia concinna* pods)	2	0	0	Per maund of 25 lb.
Tamarind	0	12	0	Do.
Strychnos potatorum nuts	2	0	0	Do.
Dammar	3	0	0	Do.
Wax	8	0	0	Do.
Cane	0	8	0	A head-load.

SECTION 5.—PAST AND CURRENT PRICES.

129. The sale prices of various kinds of timber sold in the years 1925–1935 from the depots of the Cumbum range are given below :—

Teak scantlings—9′ × 6½″ × 4½″ to 9′ × 4″ × 3″ ..	Re. 1–8–0 to Rs. 3–0–0 per c.ft.
Rosewood scantlings—9′ × 6″ × 4″ to 9′ × 4″ × 3″.	Rs. 2–0–0 to Rs. 3–8–0 per c.ft.
Vengai cart poles	Re. 1–8–0 to Rs. 3–0–0 per c.ft.
Teak felloes	Re. 1–8–0 per c.ft.
Miscellaneous species	Re. 1–0–0 to Re. 1–4–0 per c.ft.

130. The prices fetched per acre for fuel coupes in the past are given in the subjoined

Prices fetched per acre for fuel

Felling series.	1917–18.	1918–19.	1919–20.	1920–21.	1921–22.	1922–23.	1923–24.	1924–25.	1925–26.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.
SHOLAVANDAN RANGE.									
1 Moruthu	2 7	..	..	..	1 4	2 0	2 0	2 0	5 8
2 Andipatti West	4 14	8 14	8 11	4 6	8 0	7 4	10 0	7 4	2 8
3 Andipatti South	3 0	11 13	10 9	20 12	5 12	15 4	20 8	20 8	15 0
4 Andipatti Central	2 15	11 7	12 4	8 12	13 0	10 12	20 0	14 0	26 0
5 Rajadani North	8 8	8 13	13 2	12 8	12 0	15 0	16 12	11 0	15 0
6 Rajadani West	7 15	7 2	..	..	5 4	8 12	20 8	8 0	12 12
7 Vikramangalam East	7 12	10 15	15 9	18 1	14 0	10 0	17 8	17 8	14 0
8 Vikramangalam West	6 6	3 10	2 3	2 4	2 4	2 8	2 8	2 8	5 4
9 Waguthumalai	3 2	10 2	2 14	2 12	4 0	2 0	3 12	3 12	3 12
10 Sirumalai South	3 7	4 15	9 12	9 13	3 0	5 0	5 0	5 0	5 0
11 Sathiar	10 1	15 8	12 14	22 3	..	..	..	4 8	4 8
12 Sembatti	..	..	..	..	..	..	..	..	..
13 Sirumalai East	8 15	13 13	8 6	9 9	..	..	..	6 0	7 14
14 Anjukulipatti	..	..	..	..	..	..	..	..	..
15 Konapatti	..	..	..	..	..	..	..	..	..
16 Endalaparai	..	..	..	..	..	..	..	..	..
17 Ambathurai	..	..	..	..	..	..	..	..	..
NATHAM RANGE.									
1 Perumalai East	16 7	18 5	35 5	..	..	..	..	11 0	28 0
2 Mulayur	6 7	16 9	55 14	..	..	..	..	..	5 0
3 Chembulimalai	8 1	15 12	..	..	..	..	..	5 0	2 4
4 Kadavur	10 0	21 1	..	8 0	..	..	..	8 8	8 8
5 Alagarkoil	7 6	..	10 8	..	..	..	..	17 8	17 8
6 Arukkampatti	4 0	2 7	..	..	..	..	..	..	..
7 Kasampatti	11 1	13 0	21 0	..	..	..	..	6 0	5 0
8 Thethampatti	9 6	14 8	16 1	..	..	..	..	..	..
9 Vemburuli	7 2	15 6	..	..	..	..	..	3 12	2 0
10 Pudakudimalai	1 14	7 3	12 11	..	..	..	..	3 0	3 0
11 Medugamalai North	7 12	10 7	19 3	..	..	..	..	14 8	10 4
12 Medugamalai South	8 11	12 0	8 0	..	..	..	..	5 0	3 4
13 Karumalai	4 9	..	..	..	..	..	..	..	..
14 Pottapatti	5 13	12 2	12 8	..	..	..	..	10 0	5 4
15 Uduppakudi	8 10	11 14	27 8	..	..	..	..	19 8	22 0
16 Karandamalai East	4 12	8 9	19 3	..	..	..	..	7 0	7 0
17 Karandamalai North	..	..	..	..	..	..	..	..	10 2
18 Karandamalai West	..	..	..	..	..	..	..	..	..
19 Perumalai	8 0	6 0	12 0	17 0	16 0	..	..	..	5 0
20 Kanavaipatti	14 1	26 5	26 1	23 13	16 0	..	9 0	9 0	7 0
21 Kodangikuttu North	27 9	34 14	30 7	28 3	41 0	36 0	36 0	36 0	22 0
22 Kodangikuttu South	24 14	41 14	..	47 13	36 8	17 0	17 0	17 0	15 0
AYYALUR RANGE.									
1 Pillayarnatham North	..	..	..	34 15	50 0	16 4	..	..	..
2 Pillayarnatham South	18 7	52 5	31 6	32 4	56 0	31 0	..	22 4	22 4
3 Kaluvadimalai	30 0	..	17 9	26 0	15 11	20 0	20 0	..	20 0
4 Sendurai	..	..	..	40 15	56 8	60 0	..	..	..
5 Mudimalai	..	..	..	..	..	..	..	..	..
6 Shorimalai	..	..	..	22 3	80 9	60 0	..	..	..
7 Panjanthangi	27 12	33 15	21 1	36 5	65 8	72 0	72 0	..	40 0
8 A. Kombai	16 10	55 12	50 13	35 2	71 0	70 0	..	..	41 0
9 Pannamalai	16 6	36 7	34 15	24 10	51 0	43 0	43 0	..	30 4
10 Mungilkaradu	..	..	..	..	..	..	..	..	..
11 Thopaswami North	8 3	..	20 5	11 13	..	..	3 8	..	2 2
12 Thopaswami Central	10 5	..	19 7	25 6	26 0	20 0	20 0	..	5 8
13 Thopaswami South	..	..	..	38 8	41 0	50 0	50 0	..	20 8
14 Viramalai	..	..	23 4	52 0	43 0	35 0	31 0	..	..
15 K. R. Patti	..	..	28 8	47 0	37 0	31 8	27 4	33 2	43 0
16 Shorimalai	..	66 0	42 12	33 0	42 0	40 0	25 8	20 0	27 0
CUMBUM RANGE.									
1 Kombai	..	..	..	..	..	..	..	3 0	3 4
2 Machakal	..	..	..	..	..	..	..	20 0	46 0
3 Surulipatti	..	..	..	..	..	..	..	3 4	10 8
4 Suranganar	..	..	..	..	..	..	..	31 8	17 8
5 Pudupatti	..	..	..	..	..	..	..	..	..
PALNI RANGE.									
1 Virupakshi	..	..	..	..	..	..	..	..	..
2 Palni	..	..	..	..	..	..	..	..	..
KODAIKANAL RANGE.									
1 Adukkam	..	..	..	..	..	..	6 8	6 8	6 8
2 Amburuvi	..	..	..	..	..	..	..	..	..
3 Pambar	..	..	..	..	..	..	7 0	7 0	7 0
4 Iruttar	..	..	..	..	..	..	3 4	3 4	3 4
5 Sadayaperumalkoil	..	..	..	..	..	..	2 12	2 12	2 12
6 Murugamalai	..	..	..	..	..	..	..	3 12	3 8
7 Mankaradu	..	..	..	..	..	..	1 2	1 2	1 2
8 Agamalai	..	..	..	..	..	..	..	1 12	—

tabular statement :—

coupes in the Madura division.

Felling Series.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.	1934–35.
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.
SHOLAVANDAN RANGE.									
1 Moruthu	2 0	2 0	2 0	..	..	..	7 2	4 12	5 4
2 Andipatti West	..	..	..	..	30 4	26 0	18 0	21 8	19 8
3 Andipatti South	14 4	16 4	..	21 7	21 0	14 0	18 8	18 4	14 8
4 Andipatti Central	12 0	13 12	12 0	26 8	30 0	18 0	15 8	7 8	12 4
5 Rajadani North	5 4	6 8	7 4	7 12	38 8	20 4	20 0	17 8	19 0
6 Rajadani West	5 2	6 4	5 12	7 0	3. 12	5 4	6 8	13 0	..
7 Vikramangalam East	11 0	18 0	14 4	13 4	9 4	6 4	3 0	2 8	2 8
8 Vikramangalam West	4 12	5 0	3 4	3 1	2 4	4 0	2 4	2 8	7 12
9 Waguthumalai	3 12	9 0	6 4	4 4	7 4	5 4	4 12	3 4	3 8
10 Sirumalai South	5 8	15 0	34 0	20 13	16 0	14 12	10 0	..	7 4
11 Sathiar	4 4	5 8	7 12	6 8	8 4	10 0	19 4	15 0	10 0
12 Sembatti	..	..	..	12 5	12 0	18 0	20 0	..	14 4
13 Sirumalai East	6 0	5 8	8 4	13 9	21 4	15 0	15 4	14 8	25 0
14 Anjukulipatti	..	4 4	5 0	3 0	11 8	9 5	5 4	6 9	13 0
15 Konapatti	13 2	9 0	10 8	13 2	16 0	16 12	9 0	9 12	23 12
16 Endalaparai	1 4	6 0	16 0	2 0	10 12	10 0	9 0	12 8	16 0
17 Ambathurai	1 1	3 0	1 12	7 7	1 8	8 0	5 0	7 0	2 13
NATHAM RANGE.									
1 Perumalai East	15 0	12 4	13 8	35 4	23 0	15 4	..	..	4 8
2 Mulayur	3 8	11 0	5 12	7 1	30 0	20 8	14 8	14 0	26 0
3 Chembulimalai	15 8	15 8	11 8	21 8	21 4	17 8	17 8	19 0	24 0
4 Kadavur	11 8	10 0	7 8	22 5	30 0	33 8	34 0	29 0	29 0
5 Alagarkoil	3 0	11 6	10 0	..	18 4	15 0	7 8	6 8	7 8
6 Arukkampatti	4 8	4 2	4 4	13 0	16 0	10 8	20 0	6 0	7 4
7 Kasampatti	4 8	10 6	7 0	13 3	10 4	15 0	16 0	13 0	10 0
8 Thethampatti	4 14	5 0	10 0	11 1	38 4	36 0	21 0	17 0	8 11
9 Vemburuli	11 8	10 12	11 4	14 2	29 12	36 12	21 0	24 0	16 0
10 Pudakudimalai	2 8	5 4	3 4	22 4	10 4	6 8	6 8	13 8	11 4
11 Medugamalai North	9 0	16 0	36 0	32 5	45 0	45 0	20 0	16 0	17 4
12 Medugamalai South	3 6	2 8	10 0	13 14	28 12	26 0	12 0	9 0	7 12
13 Karumalai	..	..	14 4	35 6	38 12	39 12	21 0	15 0	9 8
14 Pottapatti	3 8	2 10	7 12	8 9	15 4	18 4	13 0	19 8	15 0
15 Uduppakudi	6 10	18 0	28 8	24 10	25 4	14 0	21 0	12 8	7 4
16 Karandamalai East	6 0	17 0	13 0	13 14	21 12	12 4	18 8	15 4	20 0
17 Karandamalai North	26 12	33 12	29 12	75 2	44 4	35 12	..	10 0	..
18 Karandamalai West	..	..	..	22 14	34 4	34 0	15 0	..	7 0
19 Perumalai	3 0	..	2 12	9 2	4 0	22 4	15 0	8 2	10 4
20 Kanavaipatti	29 4	27 6	23 0	26 9	17 4	30 12	10 0	10 8	5 0
21 Kodangikuttu North	24 8	31 4	28 4	61 2	58 0	34 0	..	..	7 12
22 Kodangikuttu South	22 8	23 4	28 4	94 0	50 12	34 0	26 8	18 0	15 8
AYYALUR RANGE.									
Pillayarnatham North	..	..	27 0	44 6	58 4	52 0	57 0	..	17 4
2 Pillayarnatham South	15 0	16 0	33 4	29 15	23 4	27 8	18 8	..	10 0
3 Kaluvadimalai	14 0	23 0	29 4	33 11	41 4	58 0	40 0	..	8 0
4 Sendurai	..	..	..	..	..	..	32 0	..	..
5 Mudimalai	..	..	..	78 8	65 8	37 0	20 0	..	10 0
6 Shorimalai	..	..	..	..	..	..	35 0	..	15 8
7 Panjanthangi	29 8	30 8	40 8	64 10	60 0	50 0	30 0	..	8 2
8 A. Kombai	30 8	35 4	37 12	40 15	62 0	40 0	26 0	..	10 4
9 Pannamalai	25 4	32 12	42 2	51 6	61 4	45 8	22 0	..	9 8
10 Mungilkaradu	..	..	..	26 6	47 0	35 8	30 0	..	9 2
11 Thopaswami North	2 4	5 2	7 12	11 8	15 0	12 12	15 0	..	2 0
12 Thopaswami Central	14 8	10 4	11 0	13 8	32 4	32 4	21 8	7 0	6 0
13 Thopaswami South	30 0	25 0	38 4	54 9	76 0	41 12	20 0	..	9 0
14 Viramalai	..	10 3	21 4	12 15	15 8	11 12	11 0	..	3 0
15 K. R. Patti	36 8	28 12	60 0	66 5	80 0	74 0	28 0	..	10 8
16 Shorimalai	35 0	26 14	20 0	9 0	15 4	8 0	7 0	..	5 0
CUMBUM RANGE.									
1 Kombai	..	4 12	6 12	4 13	4 0	4 0	3 4	7 8	3 6
2 Machakal	18 0	22 0	60 0	34 3	26 0	26 0	23 0	26 0	17 0
3 Surulipatti	8 4	21 0	21 0	6 6	7 0	12 8	5 0	6 8	5 4
4 Suranganar	7 0	16 0	17 0	13 3	13 0	9 0	8 0	19 0	32 2
5 Pudupatti	..	10 0	13 0	8 1	3 8	8 4	5 8	3 8	4 0
PALNI RANGE.									
1 Virupakshi	..	..	..	..	11 4	7 4	6 0	5 0	7 0
2 Palni	..	..	..	..	..	..	3 0	2 4	2 0
KODAIKANAL RANGE.									
1 Adukkam	7 0	5 8	7 8	11 0	16 8	11 4	9 0	13 0	26 0
2 Amburuvi	1 8	..	..	..	..	..	1 4	..	15 0
3 Pambar	10 0	12 0	19 0	18 3	30 0	27 0	17 8	17 0	7 0
4 Iruttar	6 4	3 0	13 0	6 11	5 0	6 4	18 8	9 8	14 0
5 Sadayaperumalkoil	4 0	2 8	2 8	2 4	2 4	2 8	2 12	2 0	2 12
6 Murugamalai	4 8	5 4	8 0	5 0	5 8	5 4	9 0	5 0	2 8
7 Mankaradu	4 6	..	..	..	..	..	1 8	1 4	1 4
8 Agamalai	..	..	..	1 2	..	..	1 4	2 14	1 10

131. Bamboo coupes have fetched prices as shown below :—

Statement showing the prices realized for Bamboo coupes in the Madura Forest Division from 1925–26 to 1934–35.

Name of range and coupes.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	1933–34.	1934–35.
				KODAIKANAL RANGE.						
Devadanapaty Series ..	C. II. 8,170 acres. Rs. 265.	C. III. 10,226 acres. Rs. 333.	C. I. 8,757 acres. Rs. 610.	C. II. Rs. 530.	C. III. Rs. 460.	C. I. Rs. 305.	C. II. Rs. 345.	C. III. Rs. 601.	C. I. Rs. 635.	C. II. Rs. 806.
Periyakulam Series ..	C. II. 4,502 acres. Rs. 351.	C. III. 4,226 acres. Rs. 210.	C. I. 8,757 acres. Rs. 300.	C. II. Rs. 370.	C. III. Rs. 305.	C. I. Rs. 375.	C. II. Rs. 505.	C. III. Rs. 346.	C. I. Rs. 525.	C. II. Rs. 451.
				PALNI RANGE.						
Vennilai and Siruvatkadu.	C. II. 2,538 acres. Rs. 1,440.	C. III. 4,270 acres. Rs. 1,010.	C. I. 3,710 acres. Rs. 300.	C. II. Rs. 1,015	C. III. Rs. 902.	C. I. Rs. 1,120.	C. II. Rs. 1,170.	C. III. Rs. 860.	C. I. Rs. 1,251.	C. II. Rs. 1,300.
Palni Series	C. III. 11,507 acres. Rs. 520.	C. I. 5,656 acres. Rs. 250.	C. II. 13,778 acres. Rs. 630.	C. III. Rs. 1,699.	C. I. Rs. 906.	C. II. Rs. 1,267.	C. III. Rs. 910.	C. I. Rs. 400.	C. II. Rs. 1,260.	C. III. Rs. 1,270.
				CUMBUM RANGE.						
Surulipaty Series	176 acres. Rs. 104.	..	Rs. 309. (Surulipaty, Suranganar and Vannathiparai Series together)	..	..	..	..	..	C. I. 7,200 acres. Rs. 300.	..
Suranganar Series ..	1,242 acres. Rs. 250.	..							..	..
Vannathiparai Series ..	..	857 acres. Rs. 115.							..	C. II. 8,900 acres. Rs. 750.
				NATHAM RANGE.						
Periyaruvi Series	..	Coupes II and III. 43 acres. Rs. 300.	..	..	..	..	..	..	..	..

132. The amounts realized by the sale of minor forest produce are tabulated below :—

Statement showing the prices realized for the Minor Forest produce leases in the Madura Forest Division from 1925–26 to 1934–35 (for ten years).

Range and nature of lease.	1925–26. RS.	1926–27. RS.	1927–28. RS.	1928–29. RS.	1929–30. RS.	1930–31. RS.	1931–32. RS.	1932–33. RS.	1933–34. RS.	1934–35. RS.
			KODAIKANAL AND PALNI RANGES.							
Minor Forest Produce and myrabolams	7,900	5,155	12,000	8,150	7,740	7,800	1,510	1,470	4,000	1,710
Myrabolams	..	..	..	..	..	..	2,015	1,026	5,000	4,090
Avaram bark	..	..	..	200	185	155	100	90	150	252
Konnai bark	..	..	..	..	..	..	70	..	..	..
			CUMBUM RANGE.							
Minor Forest Produce and myrabolams	800	802	820	825	830	610	270	550	475	701
Myrabolams	..	..	..	..	..	..	162	121	110	176
Avaram bark	..	..	..	..	..	..	..	51	..	43
Konnai bark	..	..	..	..	..	..	..	..	..	..
			SHOLAVANDAN RANGE.							
Minor Forest Produce and myrabolams	825	411	871	560	580	720	550	525	811	821
Myrabolams	..	..	..	..	..	..	60	..	..	..
Avaram bark	260	160	401	520	260	200	100	100	101	116
Konnai bark	..	..	..	..	..	..	..	..	..	30
			NATHAM RANGE.							
Minor Forest Produce and myrabolams	1,128	770	1,373	1,260	790	1,304	600	1,205	850	1,035
Myrabolams	..	..	..	..	..	..	..	..	..	..
Avaram bark	5,257	3,145	4,590	4,690	4,010	2,135	825	550	635	1,465
Konnai bark	..	..	..	..	..	..	..	..	34	..
Kaya leaves	2,000	1,505	1,610	3,705	3,710	4,785	2,050	1,000	530	400
Custard apple	..	66	110	100	33	32	37	67	32	101
			AYYALUR RANGE.							
Minor Forest Produce and myrabolams	1,229	570	615	690	590	800	251	251	326	241
Myrabolams	..	..	..	..	..	..	..	..	..	..
Minor Forest Produce old Vyampatti Range ..	225	157	200	151	200	..	35	35	50	41
Kaya leaves	515	315	502	405	390	400	57	..	40	..
Konnai bark	..	..	..	..	..	..	..	70	..	..
Avaram bark (Ayyalur range)	3,410	2,805	3,410	5,050	4,610	2,010	525	400	801	1,327
Do. Kulittalai taluk	..	..	..	1,666	1,510	625	245	225	240	240
Do. Karur taluk	800	775	754	1,500	1,100	545	215	150	176	156
Do. Lalgudi taluk	75	75	50	140	100	55	30	25	26	26
Do. Trichinopoly taluk	480	255	231	240	340	145	60	46	51	40
Whole district— *Nux vomica*	240	130	100	100	..	..	..	..	..	..

NOTE.—Prior to 1931–32 Minor Forest Produce and myrabolam leases were sold together. From 1931–32 these are sold separately.

Konnai Bark Lease.

This is sold in a rotation of five years as follows :—
First year—Ayyalur.
Second year—Natham.
Third year—Sholavandan.
Fourth year—Cumbum.
Fifth year—Kodaikanal and Palni ranges.

CHAPTER IV.—STAFF AND LABOUR SUPPLY.

133. The present staff of the division is exhibited in the subjoined statement :—

Description of staff.	Name of post.	Sanctioned strength.	Permanent or temporary.	Remarks.
Administrative ..	District Forest Officer ..	1	Permanent.	
	Assistant	1	Do.	
Executive	Rangers	6	Do.	In charge of the six ranges.
Protective	Foresters	18 + 1	Do.	One forester on lac work.
	Forest guards	88	Do.	Out of 89—One transferred to South Coimbatore and 2 not employed. (Actual strength 86).
	Reserve watchers	87	Temporary.	This is the strength after transfer of one to South Coimbatore.
Clerical	District Forest Office—			
	Head clerk	1	Permanent.	
	Accountant	1	Do.	
	Clerks	5	Four permanent.	One temporary, paid from contingencies.
	Draftsman	1	Do.	
	Typist	1	Do.	
	Range Offices—			
	Range clerks	6	Permanent.	In range offices.
Menials	District Forest Office peons.	4	Do.	
	Assistant's peon	1	Temporary.	
	Office watcher	1	Do.	
	Range peons	3	Permanent.	In Kodaikanal, Cumbum and Ayyalur ranges.
	Do.	3	Temporary.	In Palni, Sholavandan and Natham ranges.
	Tappal watchers	1	Do.	In Sholavandan range.
	Bungalow watchers	3	Do.	In Kodaikanal range for four months in the year.

134. The increase of work that will result from the adoption of extensive regeneration operations contemplated under the plan will call for an increase in the protective staff. Proposals regarding changes in staff will be found in Chapter XII of Part II.

135. *Labour supply.*—There is no dearth of labour for ordinary forest works anywhere in the division. The normal rate for unskilled work varies from Re. 0–4–0 to Re. 0–6–0 a day for adult men : women and children are paid from two to three annas. On the Palni hills the daily wage is Re. 0–8–0 for men.

Labour for felling and extraction of firewood is generally recruited from the neighbouring villages.

Odders are usually employed on roadworks.

West Coast sawyers are obtainable all through the district. Some of the Kallars of the Cumbum Valley can use the saw with a proficiency only inferior to their use of the axe.

136. *Paliyan settlement.*—When lac operations were started at Vannathiparai in 1930 it was found necessary to employ *Paliyans*—an aboriginal hill tribe—for the purpose of lopping and infecting the huge trees of *Schleichera trijuga* on which the lac was proposed to be grown. The local villagers could not be induced to climb up the huge trees and scramble out to the ends of the branches in order to prune them or to tie and untie the broodlac, while the *Paliyans* proved to be experts at this sort of work.

A settlement of ten *Paliyan* families was therefore established at Vannathiparai in 1931. Each family was given two acres of land in the reserved forest for the purpose of cultivation, free of assessment, and they are being paid at the rate of Re. 0–5–0 a day for work in connexion with the propagation and collection of lac.

137. It is proposed, under this plan, to expand the cultivation of lac in the Vannathiparai Valley. To enable this to be done successfully the settlement of *Paliyans* will have to be expanded and provision has to be made to find them other work when work on lac is slack. Suitable prescriptions to provide for these purposes will be found in Chapters VIII and XII of Part II of this plan.

CHAPTER V.—PAST SYSTEMS OF MANAGEMENT.

SECTION 1.—GENERAL HISTORY.

A. Prior to 1895.

(*a*) Madura District—General.

138. No attempt was made prior to 1852 to conserve the valuable forests of this district, though it came finally into the hands of the British in 1801, as the Government was busy with the reorganization of the system of land revenue, its first duty. In 1852, a licence to fell trees was required to be obtained from the Revenue authorities, which was free even for timber merchants. The only revenue derived from the forests was from leases of jungle produce, but even this ceased in 1854, as the leases had to be abolished consequent on oppression by official underlings.

139. In 1856, however, a beginning was made in forest conservancy by forbidding the shifting cultivation practised on the Palnis for growing plantains.

140. In 1857 Colonel Beddome reported on the rapid denudation of forests proceeding on the Palnis as a result of which a forest overseer was appointed in 1860. He took charge of the more important woodlands of the district (including those of the Palnis, the Cumbum Valley and the Karandamalais) and his duties were defined as the accomplishment of strict conservancy and meeting the demands of the Public Works Department for timber. Large areas of forests continued to be under the management of the Revenue Department, however, and on account of this dual control, considerable friction existed between the revenue and forest authorities.

141. The South Indian Railway was extended through the Madura district soon after and led to increased interest in the Madura forests.

In 1871 a small forest establishment was sanctioned, at which time the Madura forest division consisted of two ranges, the Madura range including the Sirumalais, Perumalais, Alagarhills, Nedumalais and the Natham and Aiyalur hills; and the Periyakuḷam range composed of the Upper and Lower Palnis and the forests of the Cumbum Valley.

142. In 1880, a committee composed of the Collector, Major Campbell-Walker and Mr. Gass definitely selected for reservation 21 blocks measuring some 285 square miles. The Madras Forest Act was passed into law in 1882 and between that year and 1890, most of the forests in the district were demarcated, settled and notified as "reserved forests". Nearly all of them were mapped by the Survey of India between 1888 and 1894.

143. The following statement shows the distribution of the reserves among the several taluks and their proportion to the total area :—

District.	Taluk.	Area of reserves in square miles.	Percentage of total area.
Madura	Dindigul	88	8
Do.	Madura	49	11
Do.	Melur	105	22
Do.	Palni	213	36
Do.	Kodaikanal		
Do.	Periyakulam	152	10
Do.	Tirumangalam	13	2
Trichinopoly	Kulitalai	37	25

N.B.—Zamindari forests have not been included.

144. In 1888 the district was divided into five ranges, Kanavaipatti, Sholavandan, Palamedu, Palni and Cumbum.

The problem of supplying Madura town with firewood was causing some anxiety as the railway and the spinning mills were making considerable demands on the available supply. A preliminary working scheme was therefore prepared for the Alagarhills—the main source of fuel supply, along with Waguthumalai.

(*b*) The Palnis.

145. *Cardamoms.*—The grant of leases for the cultivation of cardamoms in the sholas (tropical evergreens) of the district was recognized by Government as long ago as 1874. In 1887 the control of leases was transferred to the Forest Department. This resulted in an increase in the number of leases in reserved forests.

(c) Plantations.

146. (1) *The Velancombai teak plantation.*—In 1869–70 Colonel Campbell Walker started plantations of teak at Velancombai at the northern foot of the Palnis not far from Palni town, and at Vannathiparai near the foot of the ghat below the Periyar lake.

The Velancombai teak plantation adjoins an irrigation channel—the Rajavaikal. The locality is swampy in parts and is liable to floods. In 1870–71 it was reported that several plants died " owing to excessive water. " Its area is 4·5 acres. Further reference has been made to the present position of this plantation in paragraph 234 (1) below.

(2) *The Vannathiparai teak plantation.*—The Vannathiparai teak appears to have been proposed to be planted over 7 acres, in the midst of large trees of *Schleichera trijuga* and *Stereospermum chelonoides*, which were left standing. The present area of the plantation is only 3·43 acres.

(3) *The Mahogany plantation.*—In the year 1889, a few Mahogany seedlings (*Swietenia macrophylla*) were planted below the holy spring (Thirthathotti) in the southern valley of the Alagar hills Reserved Forest. In 1892–93, Mr. H. A. Gass appears to have planted out 15 or 16 more seedlings.

(4) *The Gundan shola plantations.* (*Eucalyptus globulus.*)—The Gundan shola Eucalyptus plantations are situated in the Gundan shola reserve adjacent to the reservoir that supplies drinking water to Kodaikanal. They were commenced in 1887–88, with a view to supply Kodaikanal with fuel and so help to save the neighbouring sholas from destruction. By 1895, 140 acres were planted up, mainly with *Eucalyptus globulus*, with a sprinkling of Australian wattles, (*Acacia dealbata, Acacia decurrens* and *Acacia melanoxylon*) and a few conifers.

(5) *The Poombarai Wattle plantation.*—The Wattle plantation, situated close to the village of Poombarai, in the Upper Palnis, consists mainly of *Acacia dealbata* with a few *Acacia melanoxylon* and one or two *Eucalyptus globulus*. It appears to have been commenced in 1883–84. A report for 1884–85 gives the total number of trees as 713 over an area of 3 acres, which was apparently the area planted in 1883–84. The plantation now extends over an area of 16·8 acres.

(d) The Cumbum Range.

147. The Cumbum Range was formed in 1888. Before 1895 certain blocks were placed under special fire protection and goats were excluded from the reserves. The villagers were, however, allowed by the Collector to take ' dry fuel ' free from the Machakal and Kombai blocks.

(e) The Trichinopoly District.

148. Before 1882 goats were free to enter all the forests and irregular fellings to make charcoal for smelting iron ore were practised on a large scale. With the advent of the Forest Act in 1882, steps were taken for the reservation of the forests: most of them were notified as reserves between 1887 and 1890. The permit system was in vogue till the year 1895.

B. 1895—1915.

(a) Madura district (General).

149. *Beginning of Working Plans.*—The year 1895 marks the abolition of the loose permit system and the recognition of the necessity for exploitation under regualr working plans. In his inspection notes of 1895 on the forests of Madura, Mr. Gass indicated certain lines on which plans might be prepared to meet the fuel demand in Madura. The reserves were classified into (1) blocks for which schemes could be prepared at once and (2) those which had to remain unworked for a period of twenty years.

150. *Madura fuel supply.*—The first Working Plan in the Madura district was prepared by Mr. Porter for the Palamedu and Kanavaipatti ranges and was sanctioned in B.P. 385 of 18th September 1900. The object aimed at was to provide fuel, small timber, manure leaves, grazing and browsing *and improvement of the forest*. The rotation was fixed at thirty years. The system was nominally " simple coppice " but fruit trees and a few sound timber trees had to be reserved wherever available, so that in practice it was really " coppice with standards. " No cultural operations were prescribed.

It was too optimistic to expect that forests which had suffered greatly from want of any control in the past could satisfy all of the several mutually incompatible objects aimed at in this Working Plan. The grazing and browsing revenue leapt up in great bounds from

about Rs. 3,000 in 1894–95 to nearly Rs. 30,000 in 1904–05. Over an area of about 35,000 acres open to goats about 50,000 goats browsed in the year last mentioned. The demand for leaf manure became enormous with the extension of cultivation under the Periyar Irrigation Scheme and the forests were lopped very heavily for the purpose. The demand for firewood also rose with the development of the railway and the spinning mills at Madura.

All these, among other causes, necessitated drastic changes in this Working Plan, which was accordingly revised by Mr. H. B. Bryant and sanctioned in 1907 and 1911 (B.P. 179, dated 7th September 1907 and 198, dated 8th August 1911).

The revised plan retained the system of " coppice with standards", reallotted the felling series excluding inaccessible localities and closed the forests to all goat browsing and loppings for manure leaf, but reduced the annual output of firewood into Madura from 20,000 tons in 1904–05 to about 12,000 tons from 1907 onwards.

The price of fuel at Madura continued to rise from 1905 and was distressingly high in 1913. The city was developing industrially and adding to its population. The annual demand for firewood in 1913 was estimated at 60,000 tons, out of which at least 30,000 tons were required for the various industries. The only sustained and reliable supply was a quantity of 23,000 tons from the Government reserves of Madura and Trichinopoly; the balance came from uncertain private sources. A memorial to Government in 1913 resulted in an order to revise the Working Plan with a view to relieve this distress.

(*b*) The Palnis.

151. *Fuel.*—The permit system prevailed till 1901. Between 1901 and 1907 the extraction of fuel in Kodaikanal range was localised in coupes in two felling series (Amburuvi and Murugamalai) and improvement fellings were introduced in the Pambar Valley. From 1907, in accordance with a scheme prepared by Mr. H. B. Bryant, systematic fellings were conducted year to year through the agency of contractors, under the " Coppice with Standards" system.

In the Palni range, fuel coupes were sold from 1907, under the " Coppice with Standards" system, prior to which the permit system was in force.

152. *Bamboos.*—Previous to 1913 the permit system had been displaced by the sale of " a group of several reserves " and " by way of compensation, one new reserve was being added each year " : no rest appears to have been allowed.

From 1913, the fellings were confined to coupes which were given a rest of 3 years between two consecutive fellings.

153. *Cardamoms.*—Leases for cardamom cultivation continued to be issued (vide paragraph 145 above) but the demand appears to have been slack.

(*c*) Plantations.

154. (1) *The Velancombai plantation.*—No further work was done during the period.

(2) *The Vannathiparai plantation.*—Nothing appears to have been done during the period.

(3) *The Mahogany plantations.*—No work appears to have been done.

(4) *The Gundan shola Eucalyptus plantations.*—Between 1896 and 1902, about 20 acres were planted up every year. The total area planted up was 240 acres. The actual planted area at present is 226·7 acres, and an extent of 25·1 acres has been handed over to the Observatory. Beginning from 1904, dead wood was sold every year mainly as firewood. In the latter part of 1905 fire appears to have entered the plantation and departmental felling of charred trees was carried out in 1906. From 1908, felling of dead wood was started in Compartment I, to meet local demand. This was given up in 1914–15 for want of sufficient dead material.

(5) *The Poombarai Wattle plantation.*—No work appears to have been done during the period.

(6) *The Kodaikanal Pine plantations.*—The Kodaikanal pine plantations are situated to the south-west of the Kodaikanal hill station, in the Gundar Valley Extension Reserve, at elevations varying from 7,200 to 8,000 feet. They owe their origin to Mr. H. B. Bryant but the object with which he started these plantations in the year 1906 has not been recorded. An old European resident of Kodaikanal appears to have mentioned to Mr. K. A. Chengappa that one of the objects was to establish a tuberculosis sanitorium in their midst (an atmosphere of pine is supposed to be good for patients suffering from this disease) which had to be abandoned owing to the strong remonstrances of the residents

of the town. In his inspection note of 1921, Mr. H. F. A. Wood has stated that the plantations were started with a view to grow valuable timber, and not for the protection and improvement of the water-supply as it was considered that the existing grassy covering of the soil was sufficient for such purposes.

The plantations were started in 1906 with seeds of *Pinus attenuata Pinus torreyana*, and *Pinus monophylla* and of the big-cone spruce, *Pseudotsuga macrocarpa*, obtained from California (U.S.A.). Between 1906 and the close of the operations in 1914–15, about 33 species of exotic conifers were tried, with varying degrees of success. Of the Himalayan conifers, *Cupressus torulosa, Taxus baccata* and *Picea morinda* were also experimented with. A complete list of the species tried will be found in a statement in the next section. However, *Pinus insignis* was found to be the best grower, followed by *Pinus attenuata, Pinus maritima Pinus ponderosa, Pinus sabiniana, Cupressus torulosa, Cryptomeria japonica* and *Sequoia washingtoniana*. An area of 927·8 acres was planted up by 1914–15 In the year 1915, it was realised that the timber of *Pinus insignis*, which formed over 80 per cent of the crop, was of practically no value. A scheme was accordingly prepared by Mr. J. S. Scot with a view to the introduction of more valuable timber species, exotic or indigenous to India, as an experimental measure. Mr. P. M. Lushington did not approve of this proposal, and the Board concurred with him. Further planting was therefore stopped in 1915.

The seeds of various Himalayan species received by Mr. J. S. Scot in 1915 were put out as seedlings over an area of 50 acres. This plantation was destroyed by a fire in March 1918.

(*d*) The Cumbum Valley.

155. Between 1895 and 1901 the forests of the Cumbum Valley continued to be exploited mainly for timber, under the permit system, and goats were excluded from the reserves. Mr. Porter's Working Plan for the forests of this valley was sanctioned in B.P. 310 of 30th September 1901. Under this plan the forests were divided into six classes :—

(*a*) fuel reserves,
(*b*) ground for browsing goats,
(*c*) evergreen forests,
(*d*) timber tracts,
(*e*) grazing grounds, and
(*f*) unproductive and unworkable areas.

The system prescribed for the working of fuel was "Coppice with Standards"; the timber tracts were to be rigidly protected from fire but no extraction therefrom was prescribed.

156. This plan remained a dead letter, except for the admission of goats into the reserves, until it was revised by Mr Bryant and sanctioned in B.P. No. 2 of 3rd January 1912. Under this plan goats were excluded from all reserves, the fuel series were reconstituted and provision was made for the exploitation of the timber forests of the valley. This plan covered also the Andipatti series now in Sholavandan range and the Valkaradu Reserved Forest delivered over to Panchayat management in 1923.

In the year 1914, however, the Board of Revenue cancelled the prescriptions relating to timber extraction. The fuel coupes continued to be worked mainly in accordance with the prescriptions of the plan.

(*e*) Trichinopoly District—Kulitalai taluk.

157. In the year 1896, a working scheme was prepared by Mr. H. A. Porter for seven out of the 19 reserves in the range (then called 'Vaiyampatti') the remaining reserves not being considered fit for working yet, owing to heavy exploitation in the past for smelting iron ore. The system was "pure coppice" on a rotation of 25 years.

158. In 1903–04, however, coupes were opened in the other reserves in order to meet the growing demand for firewood from the South Indian Railway and the Madura and Trichinopoly markets.

Subsequently the remaining reserves were also brought under a working plan and a consolidated plan for all the reserves in the range was prepared by Mr. Dupre Thornton and sanctioned in B.P. 219 of 1st December 1909.

C. From 1916 *to present times.*

(*a*) Madura district.

159. *Madura Fuel supply* —(Sholavandan, Natham and Ayyalur ranges.) Consequent upon the memorial submitted to Government in 1913 complaining of the shortage and consequent expense of fuel in Madura town a Working Plan for the fuel forests of the Madura district was prepared by Mr. C. C. Wilson and published in B.P. Land Revenue (Forests) No. 136, dated 31st August 1916.

This plan covered all the forests in Sholavandar, Natham and Ayyalur ranges, with the exception of that part of the present Ayyalur range which lies in the Trichinopoly district.

The main prescription of the plan was the adoption of the simple coppice system in place of the system of Coppice with Standards then prevailing. A careful selection of all areas which might be profitably exploited for the Madura market, and a well-thought-out scheme of extraction roads, increased the possible annual output of fuel from the reserves of Madura district from 12,000 tons to 20,000 tons. This quantity, together with the fuel supplied by the reserves in the Kulitalai taluk of the Trichinopoly district, would however, place no more than 31,000 tons in the Madura market, approximately.

Out of the total annual requirement of 60,000 tons, therefore, 29,000 tons had still to be met from private sources, which were not considered capable of supplying this quantity indefinitely. It was consequently suggested that the Eucalyptus plantations at Kodaikanal should be extended in order to prevent the possibility of a fuel famine in Madura at some future date.

A timber working circle was also constituted, consisting of three series covering a total area of about 10,000 acres. This was to be worked on the " Coppice with Standards " system on a rotation of 30 years, 60–70 poles per acre being reserved as standards.

160. *Bamboos.*—Bamboos in Alagarhill Reserved Forest were worked between 1921 and 1927 on a felling cycle of three years, in accordance with a scheme prepared by Mr. K. A. Chengappa.

(*b*) The Palnis.

161. *Fuel.*—Mr. Bryant's scheme of 1907 contemplated only three fuel series for the Kodaikanal range. By 1922 more series were found necessary and a revised scheme was prepared by Ranger A. P. Srinivasa Ayyangar, under which the number of fuel series was increased to eight. The system of working was changed to " Simple Coppice". The rotation was fixed at 30 years for four of the series and at 40 years for the remaining four. Blanks in felled coupes were to be sown with seeds of *Albizzia*, *Grewia*, *Melia*, Tamarind *Anogeissus*, teak and *Pterocarpus marsupium*.

In addition to prescribing the regeneration of blanks in fuel coupes, the scheme was so ambitious that it prescribed a "regeneration series", composed of areas very poorly stocked, which it was proposed should be regenerated by sowing the useful species listed above. This scheme has been followed in the main up to date, so far as the fuel fellings are concerned, in spite of the fact that it has received no formal sanction. The prescriptions relating to regeneration and other matters do not seem to have been followed. In the Palni range, fuel coupes continued to be sold in five different localities almost every year up to 1924–25. No coupes could be sold after 1925–26, though dead fuel appears to have been sold between 1925 and 1929. In July 1929 the Conservator called for proposals for reopening fuel working in the range as a revival of demand was expected with the opening of the Palghat-Dindigul railway during that year. A scheme was prepared by Ranger N. S. Eswara Ayyar which prescribed the opening of a fuel series near Virupakshi, to be worked under simple coppice on a rotation of 30 years. The first coupe under this scheme was worked in 1930–31.

In addition to coupes in this fuel series, fuel coupes have been sold every year in the P. V. Valley from 1932–33 onwards.

162. *Bamboos.*—The system of bamboo working noted in the previous period was replaced in 1918–19 by a scheme prepared by Mr. Woodhouse Adolphus. The bamboo area in Kodaikanal range was divided into two series—Periyakulam and Devadanapatti—in each of which one coupe was to be worked every year on a felling cycle of three years. In the Palni range three bamboo felling series were formed—Siruvatkad, Vennilai and Palni. This scheme continues in force.

163. *Brakepoles.*—The supply of brakepoles for bullock carts going down the Kodaikanal ghat road loaded with hill produce (coffee, plantains and cardamoms) was taken up by the department about the year 1921. Brakepoles are of two classes, each 5 feet long but class I is 15—18 inches in girth and Class II, 12—15 inches in girth. Poles of the required size were collected from the reserve close to Tum-tum-parai (4th mile) and sold to cartmen at 4 annas and 3 annas each for classes I and II, respectively. Any species other than teak, *Dalbergia latifolia*, *Pterocarpus marsupium*, and *Albizzia lebbek* could be felled, the resulting stumps being hammer-marked. This method was organised in a more systematic manner in 1932–33, when the required number of trees was marked for felling beforehand over a demarcated coupe and an estimate of yield of brakepoles per tree was made, a total output of 800 brakepoles being aimed at. This system continues to prevail.

164. *Timber.*—In 1923 the departmental extraction of dead and dying trees of teak, *Dalbergia latifolia* and *Pterocarpus marsupium* from the reserves of Kodaikanal range was started by Mr. K. A. Chengappa. This was discontinued in 1933 as the demand, at the prevailing scheduled rates, was small.

165. *Cardamoms.*—In the year 1923 Mr. K. A. Chengappa advocated a liberal policy in the grant of land for the cultivation of cardamoms in reserved forests. It was stated that the sholas suitable for cardamoms were in most part inaccessible and did not contain much valuable timber which could be profitably exploited. The cultivation of cardamoms did not entail any danger to the maintenance of the soil and the evergreen nature of the sholas. A handsome revenue could be ensured for long periods of time by leasing out suitable lands for cardamom cultivation, a return which such forests could not be expected to yield under other systems of management. The proposals were accepted in 1923–24 but the terms offered were not sufficiently attractive.

Revised terms were offered in 1925 as a result of which a large number of leases have been sanctioned.

In 1931, Mr. Chengappa's proposal regarding the sale of leases in auction was given effect to, with very satisfactory results.

(c) The Plantations.

166. (1) *The Velancombai teak plantation.*—The 1870 plantation was thinned in 1918 for the first time since its formation.

In 1919 Mr. H. A. Latham directed the extension of teak planting in the valley. About 90 acres were found to be suitable for the purpose.

By May 1921 an area of 5·38 acres to the northwest of the 1870 plantation was clear-felled. The area was regenerated partly by transplanting and partly by dibbling between September 1921 and September 1922.

In 1922, an area of 5·5 acres to the west of the 1921 plantation was similarly regenerated with teak between August and October 1922.

Owing to the poor results obtained further planting was given up.

(2) *The Vannathiparai teak plantation.*—The 1869 plantation apparently remained unnoticed until Mr. P. M. Lushington drew attention to it in the year 1918. It was thinned in 1919–20, probably for the first time since its formation. Thinnings were repeated in 1922–23 and 1923–24.

An extension of the plantations was ordered by Mr. P. M. Lushington. Accordingly, 14 acres were planted with teak seedlings three months old in September and October 1920.

In 1921, an area of $31\frac{1}{2}$ acres was similarly regenerated and 6 more acres in July 1922.

In 1922, wild elephants were reported to have caused considerable damage to the plantations. The percentage of casualties was found to be high and further planting was given up.

An attempt to raise *Artocarpus hirsuta* in the 1921 plantation was made in 1923 : the dibbled seeds failed to germinate.

Experiments were conducted in 1928 with a view to resuscitate the teak saplings damaged by elephants. The damaged saplings were cut back and burned over a small area and in another part a fire was first run through the area and the saplings were then cut back after the fire. A rope was stretched round the plantation, with rags tied to it, with a view to scare the elephants away. The elephants pulled down the rope, entered the plantation and continued to attack the teak. No tangible results were therefore obtained from these experiments.

A further attempt was made in 1931 to keep out elephants from the Vannathiparai valley by digging trenches across the entrances at the heads of the three valleys leading down to Vannathiparai from Travancore (Medakaranmettu, Manjanaickan and Poriparai gaps). This attempt also ended in failure, the elephants discovering other paths in some cases or the trenches ceasing to be impassable as a result of the sides falling in.

The elephants continue to damage the teak to this day : the plantation journal constitutes a record of their continuous and repeated visits.

(3) *Mahogany plantations.*—In 1921–22, 226 natural seedlings of mahogany were planted near the stream below the Tirthathotti and as many more in 1922–23. Finally, in 1923–24, seedlings of *Bassia latifolia, Gluta travancorica* and *Mahogany* were put out in the same locality.

(4) *The Gundanshola Eucalyptus plantations.*—In 1916 a coupe of one acre in Gundanshola was notified for sale but there was no demand. In 1922–23 removal of head-loads of dead fuel was permitted. A coupe of one acre in Compartment No. 1 was felled in 1923–24 but a second coupe put up for sale in the next year found no bidders. In 1926–27, Compartment No. 11 was thinned, and Compartment No. 7 in 1927–28. Owing to lack of demand only a part of the material resulting from thinnings could be sold.

In 1929 a proposal was sent up by Mr. J. A. Master to improve the plantation by retaining all dominant trees over 40″ in girth and cutting out the rest : this was not approved for want of demand for the felled material.

(5) *The Poombarai Wattle plantation.*—Dead and dying trees and windfalls in the Poombarai Wattle plantation appear to have been sold about the year 1921 : no definite information could be obtained from records.

(6) *The Kodaikanal pine plantations.*—In February 1920 a disastrous fire entered the pine plantations and burned for three days before it could be extinguished. The Conservator (Mr. H. F. A. Wood) who personally enquired into the cause of this serious catastrophe was satisfied that it was caused by an incendiary. Over 500 acres were completely destroyed out of the total planted area of 928 acres. The number of trees killed was 95,000 and the financial loss was assessed at Rs. 8,000 exclusive of supervision, protection and interest on capital.

The problem of protecting what was left after this fire was then investigated and Mr. Cox, the Chief Conservator, decided in 1921 that the best plan would be to consolidate the plantations by filling up the blanks between the several blocks with wattle (*Acacia decurrens*) and to establish a belt of the same species around the consolidated area.

The later history of the plantations is a record of the operations undertaken with a view to protect them from fire.

The creation of a fire belt of Australian wattles was attempted between 1921 and 1929 but the results were unsatisfactory though the seedlings were protected from frost.

In the year 1929, the question was attacked more systematically. Mr. T. A. Whitehead directed the sowing of *Acacia* seeds in lines scraped free of grass, in worked up soil. This met with considerable success. Further details regarding the steps that are being taken to fire-protect the pine plantations will be found under the section on fire-protection. (Vide paragraphs 291 to 293.)

A severe cyclonic storm on 6th May 1930 blew down a large number of pine trees, estimated at over 30,000. In 1931, Mr. J. A. Master prepared a working scheme for the pine plantations under which it was proposed to :—

(1) remove all dead and windfallen trees by selling them for fuel and charcoal,

(2) thin the plantations over a period of eight years,

(3) prune the side branches of all standing pine to a height of 8—10 feet from ground level, and

(4) raise a fire resistant belt of Australian wattles round the periphery of the plantations.

Though this scheme was not formally sanctioned, proposals (1) and (4) are being given effect to at present.

(7) *The Gundar Valley wattle plantation.*—In the year 1919 an area of 100 acres in the Gundar valley extension reserve, near Kaluthaveduthu, was planted with seedlings of *Acacia decurrens*, in obedience to the orders of Mr. P. M. Lushington. This plantation was destroyed by the fire which swept over the pine plantations in 1920. The area was replanted in 1920 with unsuccessful results.

(*d*) The Cumbum Valley.

167. *Fuel and Timber.*—The fuel coupes continued to be worked mainly under the prescriptions of the Working Plan sanctioned in 1912, with some deviations.

Teak plantations were raised in 1920, 1921 and 1922 in the Vannathiparai valley over 51½ acres : details will be found under paragraph 234 (2). An experimental scheme was prepared in 1926–27 by Mr. A. V. Sundaram with the object of discovering the best method of managing the superior timber areas near Vannathiparai in such a manner that the existing trees might be exploited profitably and at the same time they might be replaced by regeneration, natural and artificial, with reasonable certainty. This was sanctioned in Chief Conservator's Proceedings Ms. No. 182, dated 7th June 1927.

Nine experimental plots were opened and maintained till 1931, when the experiments were concluded.

"Dead and dying" trees and timber felled but left unremoved by timber thieves continued to be extracted but it was noticed in 1928 that "the original object had been lost sight of and *green* teak, rosewood (*Dalbergia latifolia*) and vengai (*Pterocarpus marsupium*) were being felled and removed although the object still remained the same on paper." This unauthorized felling was stopped forthwith.

In 1929 Mr. A. A. Khan was directed to prepare a scheme for the exploitation of the timber forests on the Surulipatti plateau. This scheme was ready in 1930 but was held in abeyance pending the preparation of the present Working Plan. It was however ordered that—

(1) the *Shorea* area be set aside for lac cultivation, and that improvement fellings be carried out in it with a view to favour that species and that an experiment in artificial regeneration be tried where natural regeneration was sparse, (2) experiments in regeneration be conducted in 5 plots of 5 acres each in the manner prescribed in Mr. Khan's scheme, (3) centres be established on the banks of perennial streams to propagate sandal and (4) charcoal be manufactured from *Anogeissus latifolia* to test its economic possibilities.

168. *Timber operation.*—In 1932–33, an attempt was made to reduce illicit felling of timber by the "Kallars", by the sale of 50 dead and dying trees of teak, *Pterocarpus marsupium* and *Terminalia paniculata* in the Melgudalur reserve adjoining the Kumli ghat road. The contractor who purchased the right to fell and remove the marked trees was found guilty of illicit fellings. The attempt was not repeated.

169. *Bamboos.*—Prior to 1916 the bamboos in the range appear to have been sold under the permit system.

A scheme was prepared in 1916 under which the range was divided into four bamboo felling series—Kombai, Machakal, Suranganar, Vannathiparai and Surulipatti—to be worked on a felling cycle of three years. This scheme was in operation from 1918–19 to 1925–26. The bamboos in the range appear to have flowered more or less gregariously about this time, for in 1926–27 only the Vannathiparai coupe could be sold, the other series containing no exploitable bamboo. From 1927–28 to 1932 there was practically no bamboo to sell.

In 1932 representations were made to the District Forest Officer and he was asked to reopen the sales of bamboos from the range as great difficulty was being felt by the local population for want of bamboos for general domestic use. Mr. Joseph, the Range Officer, prepared a scheme in 1932 under which the bamboo bearing area of the range was divided into three coupes, one of which was to be worked every year, on a felling cycle of three years. The coupes were located in the Surulipatti, the Vannathiparai and the Suranganar valleys.

170. *Cardamoms.*—Proposals to lease suitable areas in the range for the cultivation of cardamoms were approved in 1924. In 1926 a small area was planted with cardamoms in the High Wavy forests, departmentally, in order to induce the local people to take up leases. A large number of leases have been granted since 1929.

(*e*) The Trichinopoly District.

171. The fuel coupes continued to be worked under Mr. Thornton's plan till the end of 1916–17 when it was realized that there were large deviations from the sanctioned plan in the actual areas felled over, and that the rotation of 25 years was not sufficiently long. It was found that the areas of reserves had been wrongly computed in some cases, so that surveys of actual areas worked over and recomputations of the areas of reserves were found necessary. Sanction was obtained in B.P. Ms. No. 216, dated 31st March 1919, for what was really a revision of the Working Plan. The felling series were regrouped and the rotation was raised to 40 years. Five new felling series were constituted as a result of this revised scheme, which continues to be in force.

Difficulties in marking standards over areas heavily infested with prickly-pear, among other reasons, resulted in a change to the simple coppice system from 1922–23.

SECTION 2.—RESULTS OF PAST SYSTEMS OF MANAGEMENT.

A. Prior to 1895.

(*a*) Madura District—General.

172. The system of *free* permits introduced in 1852, under which even timber merchants could obtain licences free of payment, resulted in the wholesale cutting of trees and export

of timber to Tanjore, Trichinopoly and other distant places. Unrestricted fellings for the manufacture of charcoal for smelting iron ore continued in the "Natham hills". (Kottampatti, Karandamalai.)

The order forbidding shifting cultivation on the Palnis could not be enforced and Colonel Beddome reported in 1857 about the consequent rapid denudation of forests on the Palnis.

173. On the appointment of the Forest Overseer in 1860, licences to fell trees were issued on payment of certain fees, the more valuable timber trees were *marked* for fellings' the ryots being allowed to fell unreserved trees for agricultural purposes, within their village limits, free of charge.

174. The control exercised over the forests by an inadequate staff was very limited and was made more ineffective by continual friction with the revenue authorities as a result of dual control. In 1871 it was reported that "almost every stick had been cleared as far as the base of, and for a considerable distance up, the slopes of the Sirumalais". Deterioration of the forests due to heavy cutting for plantain gardens, coffee and fuel, and to unrestricted browsing and grazing, is reported to have resulted in 1877–78 in "disastrous floods which breached the roads and the railway in many places and made a clean sweep of all tanks lying between the Palnis and the south coast of Ramnad."

An inspection note in 1882–83 described the condition of the Alagar hills as follows :— "The hills, especially their outer slopes, have been regularly skinned of trees and shrubs for the fir wood supply of Madura and any attempt at reproduction from seed or coppice has been rendered impossible by annual fires and depasturing by herds of cattle and goats."

175. It was now recognized that all fellings must be brought under departmental supervision and that removals on seigniorage permits should be abandoned. Accordingly in 1884–85 the Alagar hills were divided into compartments and sub-compartments for the purpose of annual working. Experimental fellings over 20 acres, leaving the best grown trees standing, yielded 3·9 tons of firewood per acre and a net profit of Rs. 2.

In 1888, when the preliminary scheme for working the Alagar hills was prepared, the state of the forests was described as follows :—"All the lower slopes in Alagar hills, Waguthumalai, Sirumalais, Karandamalais and other scattered hills in the neighbourhood, have been more or less heavily indented upon in former years without any measures for subsequent protection and reproduction being adopted. The slopes of Waguthumalai towards the south and south-east are very bare owing to the constant drain for the supply of Madura town."

The preliminary working scheme for the Alagar hills prescribed fellings, in a systematic manner, *wherever there was anything left to fell* and *protecting rigidly afterwards*. This method was adopted since most of the growth had been hacked in the past and would not come to anything unless cut back. This system continued till 1894.

176. Fire protection alone was carried out with success but no cultural operations nor artificial regeneration were undertaken. The timber operations were restricted to cutting departmentally a limited quantity by selection fellings in specified reserves, and auctioning the converted material at site. Firewood was obtained by felling coupes departmentally and through contractors and permit holders. Several coupes near the railway at Aiyalur were worked for firewood and charcoal. An experiment to extract firewood along a wire-rope from the Alagar hills was reported successful.

177. By 1894, about 760 acres had been felled over in Kanavaipatti range, under "Coppice-with-Standards", a part departmentally and a part through contractors. The yield was 8—12 tons per acre for which Rs. 5 to Rs. 6 was realized. The Conservator's inspection notes of 1893 said "The coppice was not satisfactory. The standards were useless, all young growth had been removed, and the stools had not been properly trimmed. The coupes had been selected, in some cases, so as to embrace only the best of the growth at the bottom of the slopes."

178. In the Palamedu range, 378 acres had been felled departmentally, the yield being 5 tons per acre; two experimental coupes in the southern valley of the Alagar hills had yielded 6—7 tons per acre and some poles (reserving teak and *Pterocarpus marsupium*) were felled in the northern valley of the latter reserve. The result of such working was noted as "a thicket of thorns on the Alagar hills, a waste of poles which could not be sold and untrimmed stools."

179. The subjoined statement of Revenue and Expenditure shows that the sale of minor produce formed a substantial portion of the total revenue :—

Year. (1)	Revenue. Minor produce. (2)	Grazing. (3)	Total. (4)	Expenditure. (5)	Surplus or deficit. (6)
	RS.	RS.	RS.	RS.	RS.
1890–91	..	2,319	64,973	73,139	— 8,166
1891–92	23,150	2,511	65,017	68,119	— 3,102
1892–93	21,995	886	73,938	88,493	— 4,555
1893–94	22,825	3,075	69,613	59,656	+ 9,957
1894–95	23,475	2,855	47,973	48,170	— 197

The deficits were due to heavy outlay on capital works and on fire-protection.

(*b*) The Palnis.

180. *Cardamom cultivation.*—Prior to the year 1887 the right to cultivate cardamoms in the reserves and unreserves of the Lower Palnis was leased by the Revenue Department on an annual rental of 12 annas per acre, on the authority of G.O. No. 1415, dated 9th November 1874. The Board in its Proceedings No. 582, dated 4th March 1879, ordered that the control (and the revenue derived) should be with the Forest department. In 1887 the leases were transferred to the control of the Forest department.

In 1884 the Conservator of Forests, Lt.-Col. Campbell-Walker, in consultation with the Collector of Madura, Mr. Crole, proposed to increase the rate from 12 annas to Rs. 5 per acre and suggested a muchilka agreement. The Board in its Proceedings, Forest No. 328, dated 6th June 1887, declined to increase the rate to Rs. 5 but fixed it at Rs. 2.

In June 1887 the Conservator suggested to the Board that the leases be sold in auction as there was a demand for them in the Shengalvarayar reserve. This was approved in Board's Proceedings, Forest No. 394, dated 16th August 1887, and confirmed by the Government in G.O. No. 899, Revenue, dated 13th September 1887. The Government also ordered that the leases for cardamom cultivation be sold in auction both in the reserves and unreserves and empowered the Collector to deal with such cases. As ordered by the Government the sale of cardamom leases in the Lower Planis and in the Pambar and Shengalvarayar reserves was tried in March and November 1888 and April 1889 at Thandigudy and Periyakulam but there were no offers.

This fact was reported to the Board by the Collector in July 1890 and he suggested that the system of sale be given up and he may be allowed to fix an upset price for each locality in consultation with the District Forest Officer, the minimum being Re. 1 per acre. The Collector's proposal was approved in Board's Proceedings, Forest No. 514, dated 26th August 1890. The rates charged varied from Rs. 2 to Rs. 5 per acre. The period was 30 years for each lease. Lands in the Lower Palnis of the Palni range and the Shengalvarayar and Pambar reserves of Kodaikanal range were leased from 1887 to 1893. In the year 1893 there were 46 cardamom leases covering 635 acres in Kodaikanal and Palni ranges.

In 1894 the Conservator desired to extend the system of leasing lands for cardamom cultivation. The Board agreed and ordered the extension of the system, with 30 years' leases, on an annual rental of Rs. 3 per acre.

(*c*) Plantations.

181. (1) *The Velancombai teak plantation.*—In the year 1879 it was reported that one hundred trees died in the Velancombai plantation as a result of swampiness and fifty more shared the same fate in 1880. Consequently Mr. H. A. Gass reported in the latter year that the locality was unsuitable for teak owing to lack of sufficient drainage.

In 1879, the total number of surviving poles was 4,328. An expenditure of Rs. 870 had been incurred up to that date.

(2) *The Vannathiparai teak plantation.*—Drought appears to have caused severe casualties in the Vannathiparai plantation soon after formation as proposals were put forward for the digging of wells to water the transplants. The total cost of formation was Rs. 1,405 for an area of 3·43 acres which indicates that heavy expenditure must have been incurred on watering.

(3) *The Mahogany plantation.*—Many of the seedlings planted out by Mr. Gass in 1892–93 in the Mahogany plot appear to have survived.

(4) *The Gundan shola Eucalyptus plantations.*—Compartments II to VII of the Gundan shola plantations were planted out successively in the years 1889–90 to 1894–95, Compartment I having been planted in 1887–88 and 1888–89. Each compartment is 20 acres in extent.

The total cost of the planting operations was Rs. 13,922 up to the year 1895.

Four acres in Compartment I were thinned in 1893. Thirty-six poles were cut yielding 6 tons of fuel.

(5) *The Poombarai Wattle plantation.*—The total expenditure incurred on the Poombarai Wattle plantation up to 1887–88 was Rs. 533.

(*d*) The Cumbum range.

182. The privilege of free removal of "dry fuel" from the Kombai and Machakal blocks, resulted in the lopping of nearly every tree in them and in practically destroying the forests.

The general system of working was exploitation under "permits" but a few experimental fuel coupes had been worked departmentally as well as by contractors.

The "special fire protection" in vogue was largely a failure.

(*e*) Trichinopoly district : Kulitalai taluk.

183. Before reservation the forests were open to grazing by goats and unrestricted fellings for firewood and charcoal. The demand for charcoal for the smelting of iron ore found on these hills resulted in heavy mutilation of the growth over extensive areas. The damage was so intense that in 1895 twelve out of the total number of nineteen reserves in the taluk were considered to require a complete restcure for a period of 25 years.

B. 1895—1915.

(*a*) Madura district—General.

184. *Madura fuel supply.*—Mr. Porter's Working Plan for the Palamedu and Kanavaipatti ranges, sanctioned in 1901, covered an area of 158,539 acres, of which 63,001 acres were considered workable. The number of fuel felling series was 38, and the coupes ranged from 20 to 94 acres in extent. The total area to be worked over annually was about 3,000 acres, to yield an estimated outturn of 21,000 tons of firewood. The system was nominally "pure coppice" on a thirty-year rotation but the provision for the retention of fruit trees and a few sound timber trees converted it to "Coppice with standards" in practice. Cattle were to be admitted into felled coupes on payment of fees after a closure for ten years. Goats were also to be admitted after another five years at fairly high rates, but over a limited area which was changed every two years. Manure leaves were sold to ryots on a three-year rotation, over all areas except fuel coupes under ten years of age, *Wrightia tinctoria*, *Chloroxylon swietenia* and *Ixora parviflora* (sic) being protected against lopping on account of their timber value.

A fuel depot was opened in Madura and the spinning mills and the South Indian Railway were supplied with firewood departmentally.

The inaccessibility of some of the areas included in the working circle reduced the output of fuel below the estimated quantity, while the demands from the railway, the mills and the city were on the increase and were difficult to meet.

185. There was a phenomenal increase in the revenue from grazing due to the admission of goats :—

Year.	Grazing revenue.	Year.	Grazing revenue.
	RS.		RS.
1893–94	3,075	1900–01	15,357
1894–95	2,855	1901–02	19,394
1898–99	11,948	1902–03	21,212
1899–00	13,526	1904–05	29,403

In 1905, over an area of 35,514 acres open to goat browsing, 45,533 goats were reported to have browsed with permits and 5,343 without any, besides an unknown number not detected.

186. The Periyar Irrigation scheme, completed in 1895, increased the demand for leaf manure enormously, and it was estimated that in Palamedu range alone 20,000 cart-loads were removed from the reserves every year. Experimental planting of shrubs yielding leaf manure was attempted but was found impracticable.

187. The period ending with 1895 showed annual deficits in net revenue but after the adnent of this Working Plan the revenue showed substantial improvement, in spite of

heavy capital expenditure on roads and buildings. This was mainly due to the income from grazing (and browsing), manure leaf and departmental fuel supply to the mills and the railway :—

Year.	Revenue.	Expenditure. Conservancy and works.	Expenditure. Total.	Surplus.
	RS.	RS.	RS.	RS.
1895–96	57,002	18,335	46,685	10,317
1896–97	75,767	18,139	43,983	31,784
1897–98	65,294	15,188	48,134	17,160
1898–99	83,640	19,612	50,273	33,367
1899–00	73,149	16,347	47,747	25,402
1900–01	97,540	14,703	47,256	50,284
1901–02	95,321	29,114	54,994	40,327
1902–03	1,40,007	49,672	81,258	58,749
1903–04	1,72,812	65,534	97,798	75,014
1904–05	1,81,878	77,150	1,09,365	72,513
1905–06	2,26,769	1,05,023	1,39,636	87,133
1906–07	1,93,013	89,590	1,23,330	69,683
1907–08	2,12,404	95,540	1,35,597	76,807
1908–09	2,34,189	1,13,749	1,61,781	72,408
1909–10	2,57,510	1,06,479	1,56,034	1,01,476
1910–11	2,42,165	1,06,748	1,60,876	81,289
1911–12	2,53,153	1,06,152	1,57,441	95,712
1912–13	1,92,554	66,496	1,23,711	68,843
1913–14	1,44,714	61,788	1,21,300	23,414
1914–15	1,02,583	46,778	1,08,215	— 5,632 (Deficit).

188. The enormous damage caused by the goats and the loppings for leaf manure and the modifications in the felling areas necessitated partly by the increased demand for fuel in Madura and partly by the inclusion of inaccessible areas in annual coupes, compelled a revision of Mr. Porter's Working Plan. A revised plan was sanctioned in B.P. No. 179, dated 7th September 1907.

The revised plan retained the past system of working and the rotation but omitted unworkable areas, thus reducing the workable area to 60,561 acres and the total area of the annual coupes in all the felling series to 2,173 acres. It excluded goats from the reserves and *stopped* removals of manure leaf, but reduced the annual output of firewood to about 12,000 tons.

There is little doubt that but for the salutary effect of these prescriptions the forests on which Madura has always depended mainly for its fuel supply would have descended far along their way to total extinction.

189. But the industrial development of the City of Madura necessitated increasing demands on the supply of firewood to feed the spinning mills, the dyeing vats, and the railway, not to mention the rise in general domestic consumption consequent upon a growth in population. Neither the railway nor the mills had taken to burning coal, which could have released a large quantity of firewood for domestic use, as has happened since 1922. The supply could not keep pace with the demand and the reduced output resulting from the new working plan tended to heighten the difficulty. The price of firewood had been steadily rising since 1905 and rose so high in 1913 that the consequent distress among the poor resulted in a memorial to Government. Statistics were collected in 1913 by Mr. J. S. Scot, the District Forest Officer, Madura, to arrive at the annual demand for firewood at Madura. It was gathered that Madura required about 60,000 tons of firewood annually, of which 23,000 tons were estimated to come from the reserved forests of Madura and Trichinopoly districts, the balance of 37,000 tons being from private sources, which were necessarily uncertain. Out of the total consumption at least 50 per cent was estimated to be required for the various industries. A revision of the Working Plan then current was accordingly ordered in order to ease the situation and Mr. C. C. Wilson was appointed as the Working Plans Officer.

(*b*) The Palnis.

190. In the Kodaikanal range, three fuel felling series were formed under Mr. Bryant's scheme of 1907—Amburuvi, Pambar and Adukam. Coupes were sold regularly but fellings inside the coupes were irregular as the coupe contractors were in the habit of issuing permits from their houses. The purchasers who felled and removed what they wanted were subjected to little or no control so that fellings outside the prescribed limits must often have occurred especially in the initial stages of the new working.

191. The revenue and expenditure in the Kodaikanal range between 1901 and 1915 were :—

Year.	Revenue.	Expenditure.	Surplus or deficit.
	RS.	RS.	RS.
1901–02	10,018	8,293	+ 1,725
1902–03	9,019	9,886	— 867
1903–04	12,039	11,636	+ 403
1904–05	11,579	14,750	— 3,171
1905–06	11,307	15,392	— 4,085
1906–07	9,392	10,796	— 1,404
1907–08	8,536	14,235	— 5,699
1908–09	9,703	22,246	— 12,543
1909–10	10,987	20,508	— 9,521
1910–11	13,726	25,026	— 11,300
1911–12	13,983	22,728	— 8,745
1912–13	12,540	24,449	— 11,909
1913–14	13,795	22,775	— 8,980
1914–15	12,622	22,711	— 10,089

192. In the Palni range fuel coupes were worked in various localities, roughly corresponding to felling series. The subjoined statement gives details of the fuel coupes worked up to 1915 :—

Year.	Locality.	Area in acres.	Revenue.
			RS.
1907–08	Velancombai	60	600
1907–08	Kudiraiyar	35·5	178
1909–10	Velancombai C.I.	15	150
1909–10	Athicombai C.I	100	275
1910–13	Athicombai Coupes II to IV	Details not available.	Details not available.
1911–12	Velancombai C. II	15	233
1912–13	Do. C. III	15	180
1912–13	Olianuthu C.I	30	330
1913–14	Velancombai C. IV	15	300
1913–14	Athicombai C. V	50	81
1914–15	Poombarai Vilpatti C. I	30	75
1914–15	Athicombai C. VI	50	463

193. *Bamboos.*—The contractors appear to have been subjected to so little control that almost every bamboo they could lay hands on had been exploited : the bamboo was disappearing from localities comparatively easy of access.

194. The revenue realized from the main sources is given below :—

Revenue realized in Kodaikanal and Palni ranges : 1904–1915.

Year.	Fuel.		Bamboos.		Grazing.		Minor forest produce.		Total.	
	Kodaikanal range.	Palni range.	Kodaikanal range.	Palni range.	Kodaikanal range.	Palni range.	Kodaikanal range.	Palni range.	Kodaikanal range.	Palni range.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		RS.		RS.		RS.		RS.	RS.	RS.
1904–05	..	..	..	2,950	..	..	..	..	11,579	2,950
1905–06	..	..	..	2,830	..	..	..	..	11,307	2,830
1906–07	..	..	..	2,079	..	3,412	..	5,274	9,392	10,765
1907–08	..	778		3,041	..	2,117	..	8,209	8,536	14,145
1908–09	..	..	..	3,000	..	1,907	..	8,527	9,703	13,434
1909–10	..	425	..	3,660	..	6,740	..	6,187	10,987	17,012
1910–11	..	..	..	4,465	..	1,853	..	6,877	13,726	13,195
1911–12	..	233	..	4,105	..	1,519	..	7,563	13,983	13,491
1912–13	..	510	..	860	..	1,650	..	7,240	12,540	10,225
1913–14	..	381	..	2,015	..	1,568	..	9,225	13,795	13,189
1914–15	..	816	..	1,850	..	2,289	..	9,634	12,622	16,531

Note.—For Kodaikanal range only the total revenue is available.

195. *Cardamoms.*—In B.P. Forest No. 92, dated 29th April 1908, Collectors were authorized to grant not more than 150 acres on lease in Reserved Forests for the cultivation of plantation products such as coffee, cardamom and rubber, with the concurrence of the Conservator.

(c) Plantations.

196. (1) *The Velancombai teak plantation.*—The total expenditure on the Velancombai teak plantation up to 1895 was Rs. 992. The biggest tree in the plantation measured 24 inches in girth at breast height and was 36 feet high.

(2) *The Vannathiparai teak plantation.*—The Vannathiparai teak plantation appears to have attracted little attention during the period.

(3) *The Mahogany plantation.*—In 1895 there were twenty Mahogany trees in the Mahogany plantation. The best tree was 40 feet in height and 18 inches in girth at breast height.

(4) *The Gundan Shola Eucalyptus plantations.*—The following expenditure was incurred in planting Eucalyptus in the Gundan Shola plantations between 1895 and 1902 :—

Year of planting.	Expenditure.	Remarks.
	RS.	
1895–96	527	20 acres were planted every year.
1896–97	442	
1897–98	817	
1898–99	729	
1899–00	1,247	
1900–01	907	
1901–02	394	
Total ..	**5,063**	

No further planting was done. The total cost of formation was Rs. 18,985 for an area of 240 acres, i.e., Rs. 79 per acre, including Rs. 2,540 spent on wire fencing in 1889–91.

From the year 1904–05 thinnings and deadwood were sold from the plantations : the following statement shows the result of this operation :—

Year.	Compartment thinned.	Quantity of deadwood sold in cubic feet.	Amount realized.	Remarks.
			RS.	
1904–05	..	800	10	
1905–06	..	10,000	1,012	
1906–07	..	60	..	
1907–08	..	..	..	
1908–09	..	10,000	1,100	
1909–10	I	12,000	903	
1910–11	..	..	11	Sixty logs were removed and 42 head-loads of reeds. Nothing is shown as revenue against the logs, which were probably used for departmental works.
1911–12	..	5,000	100	
1912–13	..	1,000	60	
1913–14	VII	1,200	200	
1914–15	..	4,000	..	
	Total ..	**44,060**	**3,396**	

An area of 25·1 acres of the Gundan shola reserves was handed over to the Observatory in 1904–05 ; a sum of Rs. 50 was realized from them as value of the standing trees. The present net area of the plantations is 250·6 acres, including blanks and rocks.

(5) *The Poombarai Wattle plantation.*—Nothing appears to have been done, during the period, in the Poombarai Wattle plantation.

(6) *The Kodaikanal pine plantations.*—The first seedlings for the pine plantations near Kodaikanal were raised in nurseries in April-May 1906. They were basketed and put out on Pambar hill in October 1906 in pits dug 12 feet apart. The species raised were *Pinus attenuata, Pinus torreyana* and *Pinus monophylla*. Protection from frost was provided by covering the seedlings with bracken between December and March. Casualties were recorded as 49 per cent.

In 1908, *Pinus lambertiana, Pinus coulteri, Pinus ponderosa* and *Pinus insignis* were tried. Seeds were sown in April, the seedlings were basketed in November but were not planted out till the following August, 1909. This system showed a higher percentage of success. The espacement was reduced to 9 feet in some cases and to 6 feet in others.

The following statement exhibits the area and the species planted each year and the present condition of the plantations :—

Year of planting.	Block.	Net area planted. ACRES.	CENTS.	Species.	Present condition.
1906–07	I	22	25	*Pinus insignis, Pinus attenuata, Pinus maritima* and *Pinus torreyana.*	*Pinus insignis* predominates. *Pinus maritima* total failure. Others are few. Many trees blown down.
1906–07	II	12	37	*Pinus insignis* and *Pinus attenuata.*	*Pinus insignis* predominates.
1906–07	III	0	27	*Pinus insignis*	
1906–07	IV	3	40	*Pinus attenuata*	Scattered-mixed with wattle.
1909–10	I to V	5	91	*Pinus insignis*	Trees tall and of good girth.

Year of planting.	Block.	Net area planted. ACRES.	CENTS.	Species.	Present condition.
1910–11	I	9	17	*Pinus insignis*	Tall and thin, many windfalls.
1910–11	II	27		*Pinus attenuata*	
1910–11	III to V	10	29	*Pinus insignis*	
1910–11	VI and VII.	7	60	*Pinus coulteri*	Failures—Replaced by *Pinus insignis*. Fair.
1910–11	VIII	1	65	*Pinus insignis*	Tall and stout.
1910–11	IX	1	10	*Pinus sabiniana* and *Pinus coulteri*.	*Pinus sabiniana* are tall and slender. *Pinus coulteri* are suppressed and bushy.
1910–11	X	6	38	*Pinus attenuata*	Stunted and unhealthy—Windfalls many.
1910–11	XI	5	80	*Pinus ponderosa*	Failed—Replaced by *Pinus insignis* healthy.
1910–11	XII	3	..	*Cupressus torulosa*	Stunted and bushy.
1910–11	XIII	0	30	*Cupressus washingtoniana*	Complete failure.
1911–12	I to III	44	6	*Pinus insignis*	Windfalls—Fairly tall and stout.
1911–12	IV	5	30	*Pinus ponderosa*	Failed completely.
1911–12	V to VII	5	40	*Pinus insignis*	Failure or blown down in 1930 cyclone.
1911–12	VIII	1	..	*Pinus ponderosa*	Complete failure.
1911–12	IX	7	30	*Pinus attenuata*	Trees unhealthy—Poor growth—Windfalls.
1911–12	X	5	..	*Cupressus torulosa*	A few stunted trees exist.
1911–12	XI	11	60	*Pinus insignis* and *Pinus attenuata*.	*Pinus attenuata* dead or dying. *Pinus insignis* healthy—Windfalls.
1911–12	XII	8	30	*Pinus attenuata*	Healthy, in spite of 1920 fire. Thinned out owing to fire—Natural regeneration in gaps.
1911–12	XIII	2	40	*Pinus insignis*	Affected by 1920 fire and 1930 cyclone—A few trees remaining.
1911–12	XIV	5	20	*Cupressus torulosa*	Failure—Replaced partly by *Pinus insignis*.
1911–12	XV	..	70	*Pinus insignis*	Mostly blown down in 1930.
1911–12	XVI	10	60	*Pinus attenuata*	Completely burnt in 1920—Good natural regeneration of pine now.
1911–12	XVII	24	80	*Pinus insignis*	Completely burnt in 1920—Survivals blown down.
1911–12	XVIII	3	87	*Pinus sabiniana*	Complete failure.
1911–12	XIX	1	20	*Pinus ponderosa*	Failure—Replaced by *Pinus insignis*. Overrun by fire in 1920. Good natural regeneration of pine.
1911–12	XX	1	10	*Pinus coulteri*	
1911–12	XXI	5	10	*Pinus insignis*	Do.
1911–12	XXII and XXIII.	7	40	*Pinus attenuata*	Stunted—Dead or unhealthy.
1911–12	XXIV	7	60	*Pinus insignis*	Several trees blown down in 1930.
1912–13	I	84	34	*Pinus insignis*	About ¾ destroyed in 1920—Scattered. Burnt again in 1931.
1912–13	II	3	..	*Cupressus* and *Thuja*	Complete failure.
1912–13	III	2	..	*Cupressus* and *Cupressus washingtoniana*.	Do.
1912–13	IV	4	80	*Pinus insignis*	Destroyed in 1920—A few scattered survivals.
1913–14	I	7	55	*Cryptomeria japonica*	Complete failure.
1913–14	II	0	70	*Eucalyptus angliana*	Burnt in 1920. A few stunted survivals.
1913–14	III	1	00	*Pinus abinnosiana*	Failed and replaced by *Pinus insignis*.
1913–14	IV	53	70	*Pinus insignis*	Burnt in 1920—A small block at the north end has survived—Windfalls.
1913–14	V	15	70	*Pinus attenuata*	Burnt in 1920. A few isolated survivals.
1913–14	VI	12	10	*Pinus maritima*	
1913–14	VII	2	10	*Cupress washingtoniana*	
1913–14	VIII	5	60	*Pinus maritima*	Stunted, bushy and open.
1913–14	IX	33	10	*Pinus insignis*	Escaped in 1920—Windfalls in 1930.
1913–14	X	13	40	*Pinus maritima*	Stunted, bushy and open.
1914–15	I to XIII	436	..	*Pinus insignis* mostly; *Pinus maritima* over 117 acres.	Wiped out in 1920. A few scattered survivals.
	Total	**922**	**78**		

An abstract of expenditure incurred on the plantations is given below :—

Year.	Area planted. ACS.	CENTS.	Expenditure incurred. RS.
1906–07	38	29	696
1907–08		Nursery	299
1908–09	Nil.	expenditure.	641
1909–10	5	91	5,473
1910–11	45	56	9,149
1911–12	157	93	4,682
1912–13	94	14	4,619
1913–14	144	95	6,035
1914–15	436	00	2,406
Total ..	**922**	**78**	**34,000**

(*d*) The Cumbum Valley.

197. Under Mr. Porter's plan sanctioned in 1901, the fuel working circle consisted of six felling series with a total area of 7,800 acres included in the Kombai, Suranganar, Melgudalur, Vannathiparai, Surulipatti, Dhonikaradu and Andipatti North Reserves. The system was "Coppice with standards" on a 30-year rotation. Grazing and browsing were prohibited in this area.

Goat-browsing was provided for over 7,200 acres in the Buthakaradu, Puvuthukaradu and Andipatti North and South Reserves. Cattle could also be grazed in these areas.

The evergreen forests in the Kottamalai shola, Kombai block, Chinnasuruli, Kuttanachi, Vannathiparai and Tambirankanal, aggregating an area of 13,634 acres, were to be protected for climatic reasons.

Portions of the Kombai, Suranganar, Melgudalur, Vannathiparai, Surulipatti, Dhonikaradu, Pandarathorai and Kuttanachi forests, totalling 16,923 acres, were grouped to from eight "timber felling series." However most of the sound timber had already been removed under the permit system and as the areas were subject to annual fires, extraction of timber was prohibited. Areas suitable for planting were to be selected every year and artificially regenerated. Rigid fire protection was to be enforced for at least 30 years in the hope that open spaces might eventually fill up naturally. Goats were to be excluded but cattle admitted to graze.

The grazing working circle consisted of the poorer areas in the Kombai and Machakal blocks, and the Kappuvamadai, Agamalai, Valkaradu, Perumalkoilkaradu and Vellikaradu reserves, with a total area of 12,710 acres. The rest of the Cumbum Valley consisting of rocks and grass over 11,500 acres was classed as unproductive.

The cultural operations prescribed were limited to the keeping down of creepers in the Vannathiparai teak plantations by the subordinates. Taungya was recommended for the raising of the plantations referred to above. The common boundary between Madura and Travancore was to be firetraced.

198. This plan remained a dead letter, except for the admission of goats into the reserves, till it was revised by Mr. H. B. Bryant and sanctioned in B.P. (Forest) 2 of 3rd January 1912. In the interval, the demand for timber in this rich tract of land continued to be met under the old permit system, for some time. This was gradually modified by the issue of permits by officers stationed at the coupe in which fellings were executed departmentally, the public being invited to purchase permits at the coupe and take away the felled produce. When the revised plan was sanctioned in 1912, the permit system had been abolished and the system of sale by contract was fairly established. Between 1904 and 1910, however, 1,436 trees had been felled and sold from the timber forests, yielding a revenue of Rs. 46,268, i.e., an average of Rs. 32 per tree of 50 cubic feet.

199. The revised plan (1912) excluded goats from all reserves, fixed the grazing possibility at 5 acres per cow unit, and reconstituted the fuel felling series into eight new ones totalling 11,878 acres. Ten to fifteen standards were to be reserved per acre.

A valuation survey of the timber areas was made over sample plots varying from 12 to 70 acres in extent and two timber felling series, Melgudalur and Vannathiparai, were constituted, with the avowed object of meeting the local demand in a legitimate manner On the results of this valuation survey, 60 trees of teak, *Dalbergia latifolia* and *Pterocarpus marsupium* and a hundred belonging to other species, of a breast height girth of 7 feet and

above, were prescribed for extraction annually from the Vannathiparai series, and 20 teak, *Dalbergia* and *Pterocarpus marsupium* and 40 of other species, from the Melgudalur series, per annum.

Fire protection was to consist of firetracing round the worked timber coupes every year.

200. These prescriptions were carried out in the main satisfactorily. In 1914 Mr. J. S. Scot pointed out that the original enumerations were inaccurate, that the actual fellings were in excess of the possibility and that 'Kallar' labour was not being employed, in consequence of which illicit fellings continued to be rampant. On this report the Board of Revenue cancelled the prescriptions relating to timber extraction, after which timber operations were confined to the extraction of "dead and dying" trees and the collection and sale of the leavings of timber thieves. For it was difficult to put a stop to illicit removals in a locality where the country is rich, the demand ever insistent and a band of professional thieves (the Kallars) always available and ready. The fuel coupes continue to be worked up to date mainly in accordance with the prescriptions of this plan.

201. The fuel series are tabulated below :—

Serial number and name.	Locality.	Total area.	Area worked over till 1912.
1. Andipatty, South	Andipatty, South Reserved Forest ..	1,524	519
2. Andipatty, North	Andipatty, North Reserved Forest (Part).	1,434	320
3. Moruttu	Do.	1,370	120
4. Valkaradu	Valkaradu, Reserved Forest and Perumalkoilkaradu Reserved Forest.	690	444
5. Kombai	Kombai Reserved Forest (Part) ..	1,041	227
6. Machakal	Kombai Reserved Forest (Part) and Machakal Reserved Forest.	1,772	120
7. Suranganar	Suranganar Reserved Forest .. .. Melgudalur Reserved Forest .. .. Vannathiparai	1,838	578
8. Surulipatti	Dhonikaradu Reserved Forest .. .. Panadarathorli Reserved Forest .. Puvuthukaradu Reserved Forest .. Surulipatti Reserved Forest	1,693	320

Of these series, 1, 2 and 3 are now in Sholavandan range, and Valkaradu and Perumalkoilkaradu reserves have been handed over to panchayat management.

202. The following coupes were worked up to 1915 in the series now in the range :—

(1) *Kombai series.*—Coupes I to III were worked regularly from 1903–04 to 1905–06. Coupes IV and V were sold in 1907–08 and 1908–09, respectively. Coupes VI to X were sold regularly from 1910–11 to 1914–15.

(2) *Machakal series.*—Coupes I to VI were sold regularly from 1909–10 to 1914–15.

(3) *Suranganar series.*—Coupes I to XIII were worked regularly from 1902–03 to 1914–15.

(4) *Surulipatti series.*—Coupes I and II were worked in 1903–04 and 1904–05, respectively. Coupe III was worked in 1905–06 and 1907–08. Coupes IV to IX were worked regularly from 1909–10 to 1914–15.

203. The subjoined statement exhibits the financial position of the range from 1901 to 1915 : a substantial part of the revenue was derived from grazing and browsing fees :—

Year.	Revenue.	Expenditure.	Surplus.
	RS.	RS.	RS.
1901–02	12,451	6,006	6,445
1902–03	12,754	6,509	6,245
1903–04	14,884	7,430	7,454
1904–05	18,705	6,913	11,792
1905–06	24,327	7,582	16,745
1906–07	22,074	5,648	16,426
1907–08	28,527	6,739	21,788
1908–09	33,431	10,458	22,972
1909–10	28,501	9,908	18,593
1910–11	34,067	9,080	24,987
1911–12	26,646	10,733	15,913
1912–13	21,808	10,708	11,100
1913–14	31,622	13,988	17,634
1914–15	14,878	19,227	−4,349 (Deficit).

(e) Trichinopoly district—Kulitalai taluk.

204. The seven reserves considered fit for exploitation in Mr. Porter's working scheme of 1896 were :—

(1) Semmalai I and II,
(2) Karpur-Reddiapatti,
(3) Sorupam,
(4) Panjantangi,
(5) Minnakaradu,
(6) Pakkirikaradu, and
(7) Methalamalai.

The remaining 12 reserves were to be given rest to enable them to recover from heavy fellings in the past.

The system prescribed was 'pure coppice' on a rotation of 25 years and five felling series were formed in the seven reserves noted above. Grazing was allowed in coupes over five years old. The first coupes were cut in 1896.

205. In 1903–04 coupes had to be opened in the other reserves in order to meet the growing demand for firewood from the railway and from the Trichinopoly and Madura markets. Consequently the remaining reserves were also brought under working and a consolidated plan for all the reserves in the taluk (Vaiyampatti range) was prepared by Mr. Thornton and sanctioned in B.P. No. 219 of 1st December 1909.

206. The average yield per acre for the fellings between 1904 and 1907 was seven tons.

207. The revenue realized during the period was—

Year.	Amount. RS.
1903–04	10,031
1904–05	1,321
1905–06	2,243
1906–07	2,611
1907–08	5,611

208. The total area of all reserves in the range was 23,900 acres. Out of this 22,700 acres were allotted by Mr. Thornton to eleven fuel felling series, the balance of 1,200 acres on the upper slopes of Viramalai reserve being set apart for small timber to be worked at some future date, as the size of the poles was considered too small to be exploited then. The system of 'pure coppice' was replaced by "Coppice with Standards", under the same rotation as before (25 years). Fifteen to thirty standards per acre were prescribed for retention, the number increasing with the poverty of growth in the locality.

The estimated yield over an annual felling area of about 900 acres was 6,000 tons, i.e., nearly seven tons per acre.

Charcoal burning was permitted. Coupes were to remain closed for eight years after felling instead of five and goats were strictly excluded. Felled coupes were to be fenced with thorny shrubs. Grass could be removed from closed areas. The cutting of green leaves for manure was restricted to certain specified shrubs.

209. One refreshing feature of this plan was the recognition of the need for artificial regeneration of blanks in felled coupes. Broadcast sowing of indigenous species such as *Melia indica, Albizzia amara, Cassia sp.*, strip and patch sowings and planting of bamboos along suitable streams and valleys, were prescribed. Roads and bridlepaths to facilitate extraction and inspection were to be opened and maintained.

The regeneration operations do not appear to have produced any tangible results, however.

210. The eleven felling series were constituted as shown below :—

Felling series.	Reserves included.	Area in acres.	Remarks.
1. Viramalai, I	Part of Viramalai and Naganur ..	2,284	
2. Viramalai, II	Part of Viramalai, Aniyapur, A and B.	3,626	
3. Puthanatham	Puthanatham, Poigamalai, Amayapuram, Thenimalai }	2,560	Thenimalai has since been dis-reserved.
4. Karpur-Reddiapatti, North.	North slopes of Karpur Reddiapatti.	2,300	

Felling series.	Reserves included.	Area in acres.	Remarks.
5. Karpur-Reddiapatti, South.	Southern slopes of Karpur-Reddiapatti.	2,310	
6. Semmalai	Semmalai, I and II	2,406	
7. Sorupam	Sorupam .. Panjanthangi valley Minnakaradu .. Pakkirikaradu ..	2,296	
8. Panjanthangi hill ..	Panjanthangi hill Methalamalai ..	2,176	
9. Kumarikatti	Kumarikatti	1,531	
10. Sigamkaradu	Sigamkaradu	691	
11. Mogavanur	Mogavanur	520	

211. A summary of fellings carried out up to 1915 in the several fuel series is furnished below :—

Veeramalai I.—Coupes I to X were worked from 1906–07 to 1915–16, regularly.

Veeramalai II.—Coupes I to X were worked from 1906–07 to 1915–16, regularly.

Puthanatham.—Coupes I to X were worked from 1906–07 to 1915–16, regularly.

Karpur-Reddiapatti, North.—Coupes I to XX were worked regularly from 1896–97 to 1915–16.

Karpur-Reddiapatti, South.—Coupes I to VII were worked from 1896–97 to 1902–03, regularly. Coupe VIII was worked in 1903–05 and coupe IX in 1904–06. Coupes X to XX were worked regularly from 1905–06 to 1915–16.

Semmalai.—Coupes I to X were worked regularly from 1896–97 to 1905–06. Coupe XV was worked in 1906–07 ; Coupe XIV in 1907–09 ; Coupes XIII to XI in 1908–09 to 1910–11, in that order ; Coupe XVI in 1911–12 ; Coupes XVII and XVIII in 1913–14 ; and Coupes XIX and XX in 1914–15 and 1915–16, respectively.

Sorupam.—Coupe III was worked in 1898–99, Coupes I and IV in 1899–00 ; it is presumed that Coupe II was worked in 1897–98. Coupe V was worked in 1901–02 ; Coupes VI and VII in 1902–04 ; Coupe VIII in 1903–04 ; Coupe IX in 1904–07 ; Coupe X in 1905–06 ; Coupes XX to XXIV regularly from 1906–07 to 1910–11 ; and Coupes XIX to XV regularly in that order from 1911–12 to 1915–16.

Panjanthangi Hill.—It is presumed that Coupe I was worked in 1896–97. Coupes II to XX were worked regularly from 1897–98 to 1915–16, except that arrears in Coupes V, VI and VII were worked in 1903–04, along with Coupe VIII.

Kumaraikatti.—Coupes I to III were worked in 1905–07 and Coupe IV was worked in 1907–09. Coupes V to XII were worked regularly from 1908–09 to 1915–16, except that arrears in Coupes VII and IX were felled in the years following the main fellings, respectively.

Sigamkaradu.—Coupes I to III were worked 1903–04 after which coupes IV to XIV were worked regularly from 1905–06 to 1915–16.

Mogavanur.—Coupes I to X were worked regularly from 1906–07 to 1915–16.

C. *Period* : 1916 *to present times.*

(*a*) Madura district—General.

212. *Madura Fuel Supply.*—Mr. C. C. Wilson was primarily confronted with the problem of increasing the output of fuel into Madura to as high a figure as the forests could permit. It was first necessary to obtain an accurate estimate of the existing stock and its condition. Stockmaps were therefore prepared of all the forests in Sholavandan, Natham and Ayyalur ranges (part lying in Madura district) from which firewood could be supplied economically to the Madura market. These exhibited the density of stocking and the species in the reserves of these three ranges (excepting the portion of Ayyalur range lying in Trichinopoly district). They also showed, incidentally, how large a proportion of the area had become infested with the prickly-pear (*Opuntia dillenii*) and *Euphorbia antiquorum*, partly as a result of the damage to the forests consequent upon overworking in the past.

213. The average annual area to be worked under the old plan was 3,152 acres, with an estimated yield of 17,810 tons whereas, in practice, for the quinquennium preceding Mr. Wilson's revised plan, the average annual area actually worked was only 2,235 acres with an outturn of 12,690 tons. One reason for this deficit was that contractors were often unable to fell over a coupe completely in one year. The number of felling series was therefore increased and the annual coupes reduced in size, in consequence, under the revised plan.

A more detailed selection of areas suitable for exploitation resulted in increasing the average annual area to be worked from 3,152 acres to 3,817 acres (including the Timber Working Circle).

214. The adoption of the 'simple coppice' system in place of the system of 'coppice with standards' on the same rotation (30 years) in the majority of cases, as was then current, a reduction in the size of coupes and consequently an increased number of felling series and a larger area brought under working by the provision of suitable extraction roads, helped to raise the output further; it was anticipated that the annual output would rise to about 20,000 tons, including the output of fuel from the Timber Working Circle.

In the case of three series (Rajadhani North, Rajadhani West and Vikramangalam West) a rotation of 25 years was prescribed while in one case (Ambathurai) only was it considered necessary to prescribe a period of 40 years.

215. The following statement exhibits, for each of the three ranges, the prescribed number of felling series and their areas :—

Range.	Number of felling series formed.	Total area in acres.	Total average area of annual coupe, in acres.	Remarks.
Sholavandan	16	26,273	903	Ranges since reconstituted.
Ayyalur	24	43,587	1,600	Do.
Natham	16	29,491	990	Do.
Total for 3 ranges ..	**56**	**99,351**	**3,493**	

216. A brief history of each of the felling series will now be recorded :—

Sholavandan Range.

(1) *Moruthu.*—Rotation 30 years. No coupes were sold till 1921–22 for want of roads. In 1921–22 and 1922–23, the whole of coupe I and parts of Coupes II to VI were worked. Unworked portions were subsequently written off. Coupes VII and VIII were worked in 1923–24 and 1924–25. Coupe IX was worked in part in 1925–26 and the balance was written off. Coupes X and XI were worked completely in 1926–28 and 1927–29, respectively. Coupe XII was worked in part in 1928–29, the balance being written off.

In C.C.P. No. 553, dated 3rd December 1929, sanction was accorded to hold further work in this series in abeyance, for silvicultural reasons, pending revision of the Working Plan. Coupes XIII to XV were, however, worked from 1932 to 1935 under the sanction of the Chief Conservator's Proceedings No. 409, dated 6th September 1932. A cart road has since been made into the Doddappanayakanur zamin forests which will facilitate extraction from the rest of the series. This series has been worked mainly for charcoal.

Heavy illicit fellings occur in the area adjoining Kullapuram—a prominent village. Allocation of coupes require to be modified to supply Kullapuram and thus reduce illicit removals. Better protection has also to be secured.

(2) *Andipatti, West.*—Rotation 30 years. Coupes I to IX were sold from 1917–18 to 1925–26. There were no bids for Coupes X to XIII for four successive years owing to poor growth. A re-arrangement, according to which Coupes XVII to XXVII were to be worked successively from 1930–31, was sanctioned in C.C.P. Mis. No. 390, dated 1st October 1929. Coupes XVII to XXII have been worked up to the end of 1935–36.

(3) *Andipatti, South.*—Rotation 30 years. The series has been worked in the order prescribed. Small arrears in Coupes I, X and XI have been written off. Coupe XIX has been sold for 1935–36.

The eastern slopes of the Andipatti Central series go naturally with this series and will therefore be clubbed with it.

(4) *Andipatti, Central.*—Rotation 30 years. The prescribed order of felling has been adhered to. Coupe XIX has been sold for 1935–36.

The portion transferred to Andipatti South will be compensated for by addition of the Sandamalai plateau previously excluded.

(5) *Rajadhani, North.*—Rotation 25 years. The prescribed order has been adhered to : small arrears in coupes VIII and IX were written off as unworkable. Coupes I to XVIII have been worked up to the end of 1934–35. Coupe XIX has been sold for 1935–36.

Portions excluded under the current plan are subject to heavy illicit fellings and are workable. They will be included in the series.

(6) *Rajadhani, West.*—Rotation 25 years. Coupes I and II were sold in 1917–18 and 1918–19 but large arrears were left unworked. No sales could be effected for the next two years as the transport road was completed only in 1920–21. The arrears of Coupes I

and II and Coupe III were sold in 1921–22 and 1922–23 and Coupe IV was sold in the latter year. The prescribed order of fellings has been followed from 1923–24. Coupe XVIII could be sold only in 1935–36 instead of 1934–35.

(7) *Nallathevampatti.*—Transferred to panchayat management.

(8) *Mannadimangalam.*—Transferred to panchayat management.

(9) *Vikramangalam, East.*—Rotation 30 years. The prescribed order of fellings has been follwed. Arrears in Coupes IV, VIII and XI were felled in the respective succeeding years. Coupe XVIII was sold in 1934–35. Coupe XIX has been sold in 1935-36.

(10) *Vikramangalam, West.*—Rotation 25 years. The prescribed order of fellings has been adhered to. Part of Coupe I was written off as unworkable. Coupe XIV was sold but was not worked. Coupe XIX has been sold for 1935–36.

(11) *Waguthumalai.*—Rotation 30 years. Coupes I to V were sold in the years 1917–18 to 1921–22, but there were arrears every year. Coupes XXVIII and XXIX were felled in 1918–19 to augment the Madura fuel supply under Proceedings No. 625, Rout, dated 10th May 1918, of the Board of Revenue. Coupe VI could not be sold in 1922–23. A deviation was sanctioned in C.C.P. No. 236, dated 24th March 1923 under which Coupes XIX to IX were worked in that order from 1923–24 to 1933–34, an arrear in the last coupe being worked in 1934–35. Coupe XI was worked in part in 1934–35 and Coupe XXII has been sold for 1935–36. Coupes I to VIII are located on the southern slopes of the reserve which have been so heavily exploited for fuel and manure leaf in the past that there is very little left to cut. These areas require to be intensively regenerated and protected The lower slopes are very suitable for 'Kumri' for which there is demand.

The southern slopes will be constituted into a separate Kumri regeneration series. Additional areas have been added to the old series to make up the lost area.

(12) *Sembatti.*—Rotation 30 years. Coupes I to IV were sold from 1929–30 to 1932–33. An arrear in Coupe IV was felled in 1933–34. Coupe V could be sold only in 1934–35. Coupe VI has been sold in 1935–36.

(13) *Sirumalai, South.*—Rotation 30 years. Coupes I to V were worked incompletely between 1917–18 and 1921–22 owing to poor growth : the arrears were written off. From 1922–23 the fellings have progressed in the prescribed manner up to 1932–33 when part of Coupe XVI was felled, the balance being worked in 1933–34. Coupe XVII was sold in 1934–35. Coupe XVIII was sold in 1935–36.

(14) *Sathiar.*—Rotation 30 years. Coupes V and VIII were only 32½ acres and 18 acres, respectively, as against the average of 52 acres prescribed. Coupes I to IV were sold from 1917–18 to 1920–21 ; there were no sales from 1921–22 to 1923–24. Coupes V and VI were worked in 1924–25 and Coupes VII and VIII in 1925–26. Portions of Coupes IX and X were written off. Coupes XI to XVIII were worked from 1928–29 to 1935–36.

(15) *Sirumalai, East.*—Rotation 30 years. Coupe I was felled in 1917–18, a small unworked portion being written off. In 1918–19 and 1919–20, Coupes XXI and XXII were worked in addition to Coupes II and III to augment the Madura fuel supply, under Board Proceedings No. 625, Routine, dated 10th May 1918. Coupe IV was worked in 1920–22 along with arrears of Coupes XXI and XXII, a portion being written off. Coupe V was worked in 1925–27 instead of in 1921–22, a part being written off. Coupe VI was worked in 1921–22 and Coupes VII to XIX regularly from 1923–24 to 1935–36.

Extraction facilities have to be improved by a short road connecting with the Valayapatti-Anjukulipatti road.

(16) *Ambathurai.*—Rotation 40 years. Coupe I was sold in 1917–18 but was left practically unworked. No sales could be effected up to 1921–22 owing to poverty of growth. A re-arrangement of coupes was sanctioned in C.C.P. No. 375, dated 4th March 1922, under which Coupes XII to XL were to be taken up first and then Coupes I to XI. Coupes XII to XVIII were worked regularly between 1921–22 and 1927–28 but large areas were left unfelled due to poverty of growth. Coupe XIX to XXVI have been sold regularly from 1928–29 to 1935–36. The locality has been heavily overworked in the past and requires to be intensively regenerated and protected. Large areas are suitable for Kumri for which a demand exists. This series will be reconstituted by taking away the portion in the Northern Slopes and adding it to the Endlaparai series.

(17) *Endlaparai.*—Rotation 30 years. Coupes I to X were felled from 1917–18 to 1926–27 but the prescribed order could not be followed ; arrears were sold several times, the prescribed coupes being temporarily held in abeyance. From 1927–28, however, Coupes XI to XIX have been sold regularly, up to 1935–36.

A large number of sandal saplings occur all over this series, particularly in coupes IV to VI, XVI to XX and XXV to XXVII. They were tended in 1931. This series has been enlarged by the addition of the portion of the Ambathurai series on the Sirumalai Northern Slopes.

(18) *Konapatti.*—Rotation 30 years. Coupe I was sold in 1917–18. Coupe II could be sold only in 1919–20. Coupes III and IV were worked in 1920–21 and coupe V in 1921–22. There were no sales in 1922–23. Coupes VI to IX were worked from 1923–24 to 1926–27. Coupe X to XII were sold from 1926–27 to 1928–29 but were actually worked up to 1931–32. For want of a proper extraction road coupe XXX was sold in 1931–32. A cart track was constructed in 1931 from Konapatti village to coupe XIII, which was sold in 1932–33. Coupes XIV and XV were sold in 1933–34 and 1934–35. For want of proper extraction paths portions of coupes I and II and VIII to XII had to be written off. It is necessary to extend the Konapatti road to Emakkalapuram so as to establish satisfactory communication with Dindigul. Coupe XVI has been sold for 1935–36.

(19) *Anjukulipatti.*—Rotation 30 years. No coupes could be sold from 1917 to 1921 for want of proper extraction roads. The Anjukulipatti road was completed in 1921 and Coupes I and II were sold in 1921–22 but only small portions were actually worked. Coupes III to VI were also sold to the same contractor in 1922–23. By 1928–29 coupes I, II, III and V were completely worked. Coupes VII and VIII were worked from 1927–30 and 1928–31, respectively. Coupe IV was worked partly in 1928–30. Coupe XXX was sold in 1930–31, a deviation sanctioned in order to try the new Anjukulipatti road. Coupes IX to XIII have been worked from 1931–32 to 1935–36.

Natham Range.

Soon after Mr. Wilson's plan was sanctioned in 1916, a reallocation of coupes was found necessary in a large number of felling series in order to enable extraction roads to be built gradually from year to year with the progress of coupe fellings, instead of having to construct their full length in advance. The necessary deviation was sanctioned in B.P. No. 9, dated 8th March 1918.

The results of past working of the various fuel series in the range will now be summarized :—

(1) *Perumalai.*—Rotation 30 years. Coupes I to VI were worked regularly from 1917 to 1923. The prescribed order could not be followed afterwards for want of proper extraction road. A re-arrangement of coupes was sanctioned in C.C.P. No. 422, dated 20th August 1924, to enable contractors to build up a road gradually. Coupe XIII was worked in 1925–26. Coupe XXIII was worked in 1926–27 and 1927–28. A further re-arrangement was sanctioned in C.C.P. No. 766, dated 24th October 1930. There is now a transport road through Coupes VII to X toValayapatti and thence to Palamedu. Coupes XXIV to XXVI were worked from 1928–29 to 1930–31, coupe XII in 1931–32 and coupe XI in 1932–33. Coupes XXVII to XXIX were worked from 1933–34 to 1935–36.

(2) *Mulaiyar.*—Rotation 30 years. Coupes XVII to XII were worked in that order from 1917 to 1922, in accordance with the sanctioned re-arrangement referred to above. In 1923–24, the arrears of past years were worked, and no new coupe was sold. Coupe XI was worked in 1924–26 and coupe X in 1925–27. Coupes IX and VIII were worked in 1926–27 and 1927–28, respectively. Coupes VII and VI were worked in 1928–29, a part of the latter being carried forward for 1929–30. Coupe V was worked in 1929–30 and 1931–32. Coupes IV to I were worked from 1930–31 to 1933–34, regularly, and coupes XVIII and XIX in 1934–35, and 1935–36, respectively.

(3) *Perumalai East.*—Rotation 30 years. Coupes I to VIII were worked regularly from 1917–18 to 1924–25, except for a small part of coupe I written off as unworked. The gap between coupes VIII and IX excluded from working under Mr. Wilson's plan was worked as coupes VIII-*a* and VIII-*b* in 1924–25 and 1925–26, the total area being 144 acres.

Coupe IX was worked in 1925–27 and coupe X in 1926–28. Coupes XI to XV were then worked regularly from 1927–28 to 1931–32.

In place of coupe XVI a portion of the area to the west of coupe XIII, excluded under the plan, was worked in 1932–33. Coupe XVII was not felled due to jungle shrines ; Coupes XVIII and XIX were worked in 1934–35 and 1935–36, respectively.

Some areas excluded under Mr. Wilson's plan have been found suitable for exploitation (or have been already exploited) and will be included in the series.

(4) *Chembulimalai.*—Coupe I was worked in 1917–18 and coupe II in 1918–19, a portion of the latter being written off owing to poverty of growth. Coupes III to V were also written off due to lack of demand owing to poor growth resulting from persistent illicit

removals. Coupes XIII to X were worked regularly from 1923–24 to 1926–27 (C.C.P. No. 404, dated 31st August 1922) 24 acres of coupe X being excluded, as well as the whole of coupe IX. Coupe XIV was worked in 1927–28 (C.C.P. No. 298, dated 6th September 1927). Coupe XXV in 1928–29 and coupes XIX to XXIV regularly from 1929–30 to 1934–35. Coupe XXX was sold for 1935–36.

The excluded area on the northern slopes of Nedumalai is suitable for felling for the major part and will be included. Coupes III to V adjoining Pudukottai do not fetch good prices on account of incessant theft by the villagers. These coupes will therefore be worked *first*, irrespective of the price obtainable.

(5) *Kadavur.*—Coupe I was worked in 1917–18 and 1920–21. Coupe XXV was worked in 1918–19, under B.P. No. 650, Revenue, dated 10th May 1918, to augment the Madura fuel supply. Coupe II was worked in 1920–21. Coupes IV to VI were written off owing to poor growth, being situated in Kiluvamalai, under C.C.P. No. 1406, dated 8th November 1922. Coupes VII and VIII were sold together in 1923–24, on a three-year lease, but only 7 acres were felled in Coupe VII, and no road was built by the lessee. A re-arrangement was sanctioned in C.C.P. No. 4055, dated 12th June 1924, under which coupes XVII to XIII were worked regularly from 1924–25 to 1928–29, a part of XVI being worked in 1926–27. Coupe IX was worked in 1929–30, coupe VII in 1930–31 and coupe VIII in 1931–32. Coupes XXI, XXII, XX and XXIV were worked in that order from 1932–33 to 1935–36.

Excluded areas in Kiluvamalai suitable for felling will be included in the series as illicit fellings are rife in them.

(6) *Alagarkoil.*— Rotation 30 years. Coupe I was sold in 1917–18 but only 3 acres were felled. Coupe II was sold in 1919–20, but only 13 acres were felled. Coupe III was sold in 1920–21 ; 13 acres being written off. Coupes I to III contain poor scrub, and the unworked portions were written off in consequence. Coupes IV to VI were fully exploited from 1921–22 to 1923–24. In 1924–25 an area of 35 acres outside the felling series was worked as Coupe IV-*a*. Coupes VII to IX were worked from 1925–26 to 1927–28, a part of coupe VIII being excluded. Coupe X could not be sold in 1928–29 as it surrounds the perennial holy spring connected with the famous Alagar temple at the foot of the hills. In its place, coupe X-*a* of 33 acres was marked out outside the felling series and near coupe IV-*a* and worked in 1929–30. Coupes XI and XII could not be sold for reasons similar to coupe X. Under C.C.P. Miscellaneous 393, dated 4th October 1929, coupes XIII to XVIII have been worked regularly from 1930–31 to 1935–36.

The outer slopes near the temple and the interior of the valley adjoining the perennial spring will be permanently excluded. To compensate for this a fresh area to the north of Panchavarpadukkai will be added.

(7) *Arukkampatti.*—Rotation 30 years. Coupes I and II were sold in 1917–18 and 1918–19 but hardly 6 acres were felled, owing to poverty of growth and lack of proper transport route. Under C.C.P. 227, dated 2nd May 1924, coupes I to VII were transferred to areas closed to grazing owing to extreme poverty of growth. Coupe XII was worked in 1926–28, coupe XIII in 1927–28 and coupe XI in 1928–29. Coupes XXV to XXVII were worked from 1929–30 to 1931–32, arrears in coupe XXVI being completed in 1931–32. Coupes X to VII have been worked in that order from 1932–33 to 1935–36.

The area to the south of Trundikal odai is extremely poorly stocked. It will be excluded from this series and will form part of a new series to be regenerated entirely by ‘ Kumri ’.

(8) *Kasampatti.*—Rotation 30 years. Under B.P. No. 9, dated 8th March 1918, which sanctioned a re-arrangement of coupes for want of transport facilities, coupe VII was worked in 1917–18 (arrears in 1921–23) Coupe VIII in 1918–19, coupe V in 1919–20 (arrears in 1921–22) coupe VI in 1920–21 (arrears in 1922–23), coupe I in 1923–24 (arrears in 1924–25) coupe II in 1924–25 (arrears in 1925–26 and 1927–28) and coupe III in 1925–26 (arrears in 1927–28). Coupes IV and IX were written off along with small arrears in coupes VII, VIII, II and III. Coupes X to XIX were worked regularly from 1926–27 to 1935–36. A re-arrangement of coupes will be proposed to facilitate extraction.

(9) *Tethampatti.*—Rotation 30 years. A re-arrangement of coupes was sanctioned from the commencement in B.P. No. 9, dated 8th March 1918, to enable the gradual construction of transport facilities. Coupes VI to IV were worked from 1917–18 to 1919–20, part of coupe VI being written off. Coupe I was worked in 1920–21 and coupe II in 1921–22 along with arrears of coupe IV, but part of coupe II had to be written off. There were no offers from 1923 to 1925 owing to transport difficulties. A further re-arrangement of coupes was sanctioned in C.C.P. No. 428, dated 21st August 1924. Coupe XIII was

worked in part in 1926–27, and coupe XIV in 1927–28, coupe X in 1928–29, coupe XV in 1929–30, coupe IX in 1930–31, coupe VIII in 1931–32 and 1932–33 ; Coupe III in 1932–33 ; Coupe VII in 1933–34 and coupes XVI and XVII in 1934–35 and 1935–36, respectively.

The series will be reconstituted by exclusion of unworkable areas and inclusion of areas from adjoining felling series.

(10) *Vemburli.*—Rotation 30 years. Coupe I, in Sanamalai, was sold in 1917–18 but 34 acres were left unworked. Coupe XXVII was worked in 1918–19 under special sanction, to augment the Madura fuel supply. Coupe II was worked in part in 1920–21, 34 acres remaining unfelled. Coupes III to V and the unworked areas of I and II were written off. Coupes VI and VII were worked in 1923–24 and VIII to XIX were worked regularly from 1924–25 to 1935–36, a portion of VIII being written off. The series will be reconstituted by slight exchanges between other neighbouring series.

(11) *Budagudimalai.*—Rotation 30 years. B.P. No. 9, dated 8th March 1918 sanctioned the re-arrangement of coupes under which coupes X to VI were worked in that order from 1917–18 to 1921–22, portions of VII and VIII being written off. Coupe V was worked in 1924–25, about half the area being written off. Coupes III and II were worked in 1925–26 and 1926–27, respectively. Coupes I and IV were worked in 1927–28 portions being written off. Coupe XII was worked in 1928–30, coupe XI in 1929–30,coupe XIII in 1929–31, coupe XIV in 1930–31 and XV to XIX from 1931–32 to 1935–36, a portion of coupe XVI being completed in 1934–35. A small area excluded previously has now been found suitable for working.

(12) *Methugamalai North.*—Rotation 30 years. Coupes I to XIX have been worked regularly from 1917–18 to 1935–36.

(13) *Methugamalai South.*—Rotation 30 years. Coupes I to VII were worked regularly from 1917–18 to 1924–25, a small part of coupe VII being written off. Only 7 acres were felled in coupe VIII in 1925–26 : the balance had to be written off. Coupes IX to XI were worked regularly from 1925–26 to 1927–28. Coupe XII could not be sold due to a series of jungle shrines in it. Under C.C.P. L. Dis. No. 18, dated 12th January 1928, coupes XIII to XX have been worked regularly from 1928–29 to 1935–36. Coupe XII will be permanently excluded from the series.

(14) *Karumalai.*—Rotation 30 years. Coupe I was sold in 1917–18 but only 2 acres were felled for want of transport facilities and poverty of growth. Attempts to sell coupes were made till 1924, with no success. The series was then closed to working under C.C.P. No. 227, dated 2nd May 1924. In 1927, Mr. Stileman proposed to open that part of the series for working for which facilities of transport were fair and this was sanctioned in C.C.P. No. 304, dated 10th September 1927. Coupes XXIV to XXX were worked regularly from 1928–29 to 1934–35 and coupe XIX has been sold for 1935–36. Transport facilities will be improved by acquisition of necessary private land to secure a right of way.

(15) *Pottapatti.*—Rotation 30 years. Coupe I is situated immediately above the village of Valacheripatti on steep hill slope with overhanging boulders. It was therefore abandoned and a rearrangement of coupes sanctioned in B.P. No. 9, dated 8th March 1918, under which coupes IV to VII were worked from 1917–18 to 1920–21, arrears in these coupes being worked in 1920–22. Coupes VIII was written off owing to jungle shrines. Coupes IX to XII were worked regularly from 1922–23 to 1925–26, part of XII being completed in 1926–27. Coupe III was worked in 1926–27 and Coupe II in 1927–28. Coupes XIII to XX were worked regularly from 1928–29 to 1935–36. Coupe I will be permanently excluded from working.

(16) *Udupugudi series.*—Rotation 30 years. Coupes I to IV were worked from 1917–18 to 1920–21, a part of IV being written off. Since the cart track up the Kalanai Valley had not been constructed Coupe V could not be sold and a deviation was sanctioned in C.C.P. 1939, dated 15th December 1921 under which Coupes XI and XII were worked in 1922–23, part of the former being worked in 1923–24. Coupe XIII was worked in 1923–24 and 1925–26, Coupe XIV in 1924–25 and Coupe XV in 1925–26. Coupe V was worked in 1926–27. (Part was written off). The transport road was not yet ready so that another deviation was sanctioned in C.C.P. 297, dated 6th September 1927 under which Coupe X was worked in 1927–28 and Coupes XVI to XIX from 1928 –29 to 1931–32. Coupe XXI was worked in 1932–33, and Coupe XX in 1933–34. The writer recommended Coupe XXX for 1934–35, which was worked accordingly. Coupe VII was put up for auction in 1935–36 but did not attract offers for want of transport facilities and because of certain shrines in the locality.

The area infested with shrines will be permanently excluded from the felling series.

(17) *Karandamalai East.*—Rotation 30 years. Coupes I to XIX have been worked regularly from 1917–18 to 1935–36, except that arrears were completed in the succeeding

years in the case of Coupes II, III, IV, V, VII, IX and XVI. Small areas in Coupes V and X were written off as unworkable and 17½ acres in Coupe VI and a part of Coupe XVI were excluded for shrines.

(18) *Kanavaipatty.*—Rotation 30 years. A rearrangement of coupes was found necessary from the start owing to transport difficulties, and was sanctioned in B.P. No. 9, dated 8th March 1918. Coupes VIII to IV were worked regularly in that order from 1917–18 to 1921–22, part of Coupe IV being written off as unworkable. Arrears in Coupe V were worked in 1922–23. Coupe III was worked in 1924–26, Coupes XVII to XV were worked together from 1925–29; Coupe II in 1926–28, and Coupes I and IV in 1928–30. Thus, by selling 2 and 3 coupes, at a time, the working was brought to agree with the plan in 1929–30. Coupes XIII to IX were then worked regularly from 1929–30 to 1933–34 and Coupes XVIII and XIX in 1934–35 and 1935–36, respectively.

(19) *Karandamalai West.*—Rotation 30 years. Coupe I was worked in 1929–30, in accordance with the plan Coupe II was worked next year, a portion being written off; Coupe III was worked in 1931–32, a portion being written off; Coupe IV was worked in 1932–34, Coupe V in 1934–35 and Coupe VI in 1935–36.

(20) *Karandamalai North.*—Rotation 30 years. Coupes I to VI were worked regularly from 1925–26 to 1930–31, arrears in Coupe V being completed in 1931–32. Coupes VII and VIII were worked in 1931–32 and 1932–33, respectively, part of the latter being written off. Coupe IX was sold for 1935–36. The felling series will be enlarged by the addition of part of the area allotted originally for timber felling.

(21) *Kodangikuttu North.*—Rotation 30 years. The original allocation of coupes was revised at the start in B.P. No. 9, dated 8th March 1918, so as to commence the two series at different places. Coupes XXIV, XXIII, XXV to XXX, XXII to XVII and XIII were worked in that order, regularly from 1917–18 to 1931–32. There were no offers in 1932 and 1933. Coupes XII and XIV were worked together in 1934–35. Coupe XVI did not find a sale in 1935–36.

(22) *Kodangikuttu South.*—Rotation 30 years. The original allocation has been adhered to. Coupe I was worked in 1917–18, Coupe II in 1918–19. Coupe III in 1920–21 and Coupes IV and V in 1921–22. Coupes VI to XIX were then worked regularly from 1922–23 to 1935–36.

Ayyalur range.

(1) *Pillayarnatham North.*—Rotation 30 years. Coupes I to III were felled from 1920–21 to 1922–23, five years in advance of prescriptions, on account of special demand in Madura (C.C.P. No. 74, Miscellaneous, dated 7th February 1920). The series was therefore given rest up to 1928–29 and the work started according to plan in that year. Coupes IV to VIII were felled from 1928–29 to 1932–33 and Coupes IX and X in 1934–35 and 1935–36, respectively.

(2) *Pillayarnatham South.*—Rotation 30 years. A reallocation of coupes was sanctioned from the beginning in B.P. No. 9, dated 8th March 1918, to facilitate extraction. Coupes XVI to XI were worked regularly from 1917–18 to 1922–23 : no coupe was sold in 1923–24 : Coupe X was sold in 1924–25, and Coupes IX and VIII together in 1925–26. Coupes VII to I were worked in that order regularly from 1926–27 to 1932–33. No coupe was sold in 1933–34. Coupes XVII and XVIII were worked in 1934–35 and 1935–36, respectively.

(3) *Kaluvadimalai.*—Rotation 30 years. Coupe I was worked in 1917-18, but Coupe II was worked only in 1919–20 (B.P. No. 625, Rt., dated 10th May 1918). Coupe III was worked in 1920–21, Coupes IV and V together in 1921–22, arrears of Coupe V being completed in 1922–23, along with Coupe VI. Coupe VII was felled in 1923–24 and Coupe VIII and IX in 1924–25 to 1926–27. Coupes X to XVI were worked from 1926–27 to 1932–33, regularly. No coupe was sold in 1933–34. Coupes XVII and XVIII were worked in 1934–35 and 1935–36, respectively.

(4) *Sendurai.*—Rotation 30 years. Coupes I to III were felled from 1920–21 to 1922–23, in advance of prescriptions, owing to special demand at Madura (C.C.P. No. 74, dated 7th February 1920). To compensate for this, work was ordered to be commenced according to plan only in 1932–33 and Coupe IV was worked accordingly in that year. No coupes have found sale since, mainly due to want of a proper extraction road. The allocation of coupes will be altered to facilitate extension of road system by contractors.

(5) *Mudimalai.*—Rotation 30 years. Coupes I to IV were worked regularly according to plan from 1929–30 to 1932–33. There was no demand in 1933–34. Coupes V and VI were worked in 1934–35 and 1935–36, respectively.

(6) *Shorimalai.*—Rotation 30 years. Coupes I to III were felled from 1920–21 to 1923–24, in advance of prescriptions, owing to special demand in Madura (C.C.P. No. 74, dated 7th February 1920). Work was resumed in 1932–33 when Coupe IV was worked. Coupes V and VI were felled in 1934–35 and 1935–36, respectively, there being no demand in 1933–34.

(7) *Panjanthangi.*—Rotation 30 years. Coupes I to VII were worked regularly from 1917–18 to 1923–24. Arrears in Coupes VI and VII were worked in 1924–25. Coupes VIII and IX were worked together in 1925–26 after which Coupes X to XVI were worked regularly from 1926–27 to 1932–33. No coupe was sold in 1933–34. Coupes XVII and XVIII have been worked in 1934–35 and 1935–36, respectively.

(8) *A. Kombai.*—Rotation 30 years. Coupes I to VI were worked regularly from 1917–18 to 1922–23, arrears in the last coupe being completed in 1923–24. No coupes were sold in 1923–25. Coupes VII and VIII were sold together in 1925–26 and coupes IX and X together in 1926–27. Coupes XI to XVI were worked regularly from 1927–28 to 1932–33. No coupe was sold in 1933–34. Coupes XVII and XVIII were worked in 1934–35 and 1935–36, respectively.

(9) *Pannamalai.*—Rotation 30 years. Coupes I to VII were worked regularly from 1917–18 to 1923–24, arrears in Coupes VI and VII being worked in 1924–25. Coupes VIII and IX were worked together in 1925–26, after which Coupes X to XVI were worked regularly from 1926–27 to 1932–33. No coupe was sold in 1933–34. Coupes XVII and XVIII have been worked in 1934–35 and 1935–36, respectively.

(10) *Mungilkaradu.*—Rotation 30 years. Coupe I was worked according to plan in 1929–30, and Coupes II to IV from 1930–31 to 1932–33, regularly. No coupe was sold in 1933–34. Coupes V and VI were worked in 1934–35 and 1935–36, respectively.

(11) *Thopaswamimalai South.*—Rotation 30 years. Coupes I to IV were worked from 1920–21 to 1923–24, arrear coupes being completed in 1924–25. Coupes V and VI were worked in 1925–26 and Coupes VII to X felled regularly from 1926–27 to 1929–30. A re-arrangement necessitated by immaturity of crop was sanctioned in C.C.P. No. 360, dated 28th May 1930, under which Coupe XXIX was worked in 1930–31, and Coupes XIX and XVIII, in 1931–32 and 1932–33 and Coupe XVII in 1934–35. Coupe XV was sold for 1935–36.

(12) *Thopaswamimalai Central.*—Rotation 30 years. Coupe I was worked in 1917–18, but Coupe II was felled only in 1919–20. Coupe III was worked in 1920–21, and Coupe IV and V together in 1921–22. Coupe VI was worked in 1922–29 ; Coupes VII and IX together in 1923–26 ; Coupes VIII and X together in 1926–27. Coupes XI to XVI were worked regularly from 1927–28 to 1932–33, part of Coupe XIII being completed in 1933–34, and part of Coupe XVI in 1934–35. Coupe XVII was felled in 1934–35. Coupe XVIII was proposed by the writer outside the old felling series and has been sold for 1935–36.

(13) *Thopaswamimalai North.*—Rotation 30 years. Coupe I was worked in 1917–18, Coupe II in 1919–20 and Coupe III in 1920–21. Coupes IV and V were sold in 1921–22 but could not be felled for want of transport road. A re-arrangement of coupes was accordingly sanctioned in C.C.P. No. 207, Rt., dated 15th March 1923, but could not be adhered to. Coupe VII was felled in 1923–24.

Coupes IX and XI were worked from 1925 to 1928. Coupes XIII, XV and XVI were sold in 1926–27 but Coupes XV and XVI could be completed only in 1928–29 ; Coupes XVII and XVIII were worked in 1927–28 ; Coupe XIX in 1928–29. Coupes XIV, XII and X were worked in that order from 1929–30 to 1931–32. Coupes VIII and VI were worked together in 1934–35 and Coupe V has been sold for 1935–36.

The felled material is being largely converted into charcoal.

217. The Timber Working Circle was divided into three series, one in each of the Ayyalur, Natham and Sholavandan ranges. The series in Ayyalur range was transferred to Natham range subsequently. The working circle covered the pole areas on the tops of the Karandamalais, the Sirumalais and the Alagar Hills. The average area of the annual coupe was about 100 acres.

218. An attempt was made to work the Karandamalai series between 1921 and 1928. Coupe I of 103 acres was sold in 1921–22 but only 18 acres were actually felled. In 1922–23, 31 acres of Coupe I were felled along with 21·5 acres of Coupe II. In 1923–24 and 1924–25, 41·5 acres in Coupe II were felled. Fifteen acres in coupe III were felled in 1925–26. Coupe II was completed in 1926–27, as well as 53 acres in coupe III, and in 1927–28, 41 acres in coupe I were felled : there remained a balance of 13 acres in coupe 1 and 73 acres in coupe III.

219. The working of the timber series depended on the construction of roads prescribed in the working plan for the postponement of which sanction was obtained in C.C.P. No. 437, dated 26th November 1928. Since extraction was difficult without the prescribed roads, and since the areas were considered to be better suited for sandal propagation, further work in the timber working circle was closed under C.C.P. Mis. No. 627, dated 4th December 1930.

220. *Artocarpus hirsuta.*—In the year 1921–22, 272, c.ft. of *Artocarpus* timber was exploited from the Kalanai valley of the Karandamalai reserve. Part of it was used in departmental buildings, and the balance was offered for sale in 1922–23, unsuccessfully. But it was sold in 1923–24 for Rs. 197 (130 c.ft).

(*b*) The Palnis.

221. *Fuel : Kodaikanal range.*—In the Kodikanal range, fuel coupes continued to be worked in the Amburuvi, Pambar, Adukam and Murugamalai reserves in accordance with Mr. Bryant's scheme. Coupes appear to have been worked every year regularly. The total areas exploited from the commencement up to 1922–23 are tabulated below, along with the yield and the average prices realized per acre :—

Reserves.	Areas worked.	Average yield per acre.	Average price realized per acre.
	ACS.	TONS.	RS.
Amburuvi	805	7	9
Pambar	188	17	19
Adukam	827	7	14
Murugamalai	494	4	6

Ranger Srinivasa Iyengar's scheme was brought into force in the year 1923–24.

The results of working under this scheme are described below :—

(1) *Agamalai series.*—Rotation 30 years. Coupes I and II were worked in 1923–24 and 1924–25, respectively. Coupes III and IV were worked in 1929–30. Coupes V to VIII were worked regularly from 1932–33 to 1935–36.

(2) *Amburuvi series :*—Rotation 30 years. Coupe I was worked in 1926–27, but Coupe II was worked only in 1932–33. Coupe III found no sale in 1933–34. Coupes IV and V were worked in 1934–35 and 1935–36, respectively.

Coupe III contains a good deal of soft woods and will therefore be worked last and *regenerated.*

(3) *Pambar series.*—Rotation 30 years. Coupes I to XIII were worked regularly from 1923–24 to 1935–36.

(4) *Adukkam series.*—Rotation 30 years. Coupes I to XII were worked regularly from 1923–24 to 1934–35. Coupe XIII was proposed by the writer and has been sold for 1935–36.

(5) *Murugamalai series.*—Rotation 40 years. Coupes I and XII were worked regularly from 1923–24 to 1934–35. Coupe XIII has been sold for 1935–36.

(6) *Iruttar series.*—Rotation 40 years. Coupe II was worked in 1924–25 and coupes I to III in 1925–26. Coupes IV to XIII have been worked regularly from 1926–27 to 1935–36. The coupes are now getting beyond transport limits. Future coupes will be prescribed where easier facilities exist.

(7) *Sadayaperumal series.*—Rotation 40 years. Coupes I to XIII have been worked regularly from 1923–24 to 1935–36.

The portion of this series in Mankaradu reserve will be added to the Mankaradu series—the loss will be made up by the shorter rotation adopted.

(8) *Mankaradu series.*—Rotation 40 years. This series is partly in Kodaikanal range, the other part being in Palni range. Coupes I to IV were worked regularly from 1923–24 to 1926–27 and coupes V to VIII from 1932–33 to 1935–36. The series mainly supplies the town of Vattalakundu, so that the demand is small though certain. It is not advisable to work part of the series in the Marudanadiar reserve of Palni range as obtains at present, since the latter is far away from the centre of consumption.

The series will in future be confined to the Kodaikanal range.

222. *Fuel : Palni range.*—The subjoined statement exhibits the working of fuel coupes in the Palni range from the year 1916 onwards :—

Year.	Locality.	Area in acres.	Revenue realized.
			RS.
1915–16	Virupakshi—Coupe I	50	90
	Poombarai Vilpatty Valley—Coupe II	50	250
	Athicombai—Coupe VII	50	188
1916–17	Olianuthu—Coupe I *b*	22	80
	P.V. Valley—Coupe I *b*	26	75
	Athicombai—Coupe VIII	49	160
1917–18	Virupakshi—Coupe III	30	46
	P.V. Valley—Coupe III	49	100
	Athicombai—Coupe IX	30	95
1918–19	P.V. Valley—Coupe IV	32	60
	Athicombai—Coupe VI *b*	40	97
1919–20	P.V. Valley—Coupe V	34	65
	Athicombai—Coupe VII *b*	25	155
1920–21	Olianuthu—Coupe I *c*	21	65
	Virupakshi—Coupe IV	30	60
	P.V. Valley—Coupe VI	30	551
	Athicombai—Coupe VIII *b*	33	100
1921–22	Virupakshi—Coupe V	35	70
	P.V. Valley—Coupe VII	33	231
	Athicombai—Coupe IX	22	88
1922–23	P.V. Valley—Coupe VIII	27	86
	Athicombai—Coupe X	23	127
1923–24.	....	..	..
1924–25	P.V. Valley Coupe VIII *b*	24	48
	Athicombai—Coupe XI	22	110

Under the scheme prepared by Ranger Easwara Ayyar, work in Virupakshi fuel series was commenced in 1930–31 when Coupe I was felled. Coupes II to VI have been worked regularly from 1931–32 to 1935–36.

A new series of coupes was opened in the Poombarai-Vilpatty Valley reserve, near Palni town, in 1932–33 in which year Coupe I was sold but very little was actually worked. Coupes I and II were worked together in 1933–34 and Coupes III and IV were worked in 1934–35 and 1935–36, respectively.

223. *Bamboos.*—Bamboos continued to be sold as before, without a definite scheme, till the year 1918.

Bamboo coupes have been sold every year regularly from 1918–19 in both the ranges under the scheme prepared by Mr. Woodhouse Adolphus.

224. *Brakepoles.*—Under the existing scheme ten coupes have been marked on the map, lying on both sides of the Kodaikanal ghat road, beginning from ‘ Tum-tum-parai ’ and ending at the Iruttar. The areas of the coupes differ considerably from one another. Trees of all species with the exceptions already noted (in paragraph 163) are marked for felling, up to a maximum girth of about 4 feet, and the estimated outturn of brakepoles from each marked tree is noted. As many trees are marked for felling in a coupe as are likely to yield a total of about 800 brakepoles, this being the estimated average consumption per year. The total number of trees felled for the last three years have varied from 125 to 160 per year which gives an average of 4 trees per acre of the annual coupe. Coupe III is under working for 1935–36.

The stools resulting from fellings have either failed to produce coppice shoots or the shoots, where they exist, are lacking in vigour. This is to be expected because of the insufficiency of light attendant upon the method of working practised. Nor has there been any attempt at the artificial regeneration of the gaps created.

Cardamoms.

225. In the year 1917 the period for new leases was reduced to 25 years.

In 1923 there were 121 leases in the Palni hills, covering an area of about 1,600 acres and there were applications for about 2,000 acres of fresh land. It was then the policy to discourage the grant of fresh leases but the District Forest Officer, Mr. K. A. Chengappa, strongly advocated the grant of more leases. He recommended that the cost of demarcation and survey of the areas should be borne by the lessees in addition to an annual assessment of Rs. 5 to Rs. 7–8–0 per acre, depending on the nature of the locality. He hoped that it might also be possible to secure a price of Rs. 5 to Rs. 10 per acre by way of premium for the occupancy right, in the case of favourably situated areas : in such cases the occupancy right would be put up to auction. Mr. Chengappa's proposal was approved in

C.C.P. Mis. No. 598, dated 20th December 1923 and in C.C.P. Mis. No. 24, dated 1st December 1924, permission was given to grant cardamom leases in the High Wavy Mountains of Cumbum range on similar terms. A large number of applications for the grant of cardamom leases both on the Lower Palnis and in Cumbum range were received, but very few were willing to pay a rate of Rs. 5 to Rs. 7–8 per acre per annum on the Palnis, and none in Cumbum range, as cardamom lands were obtainable on patta in the Travancore forests adjoining our reserves at a rate of Rs. 2 per acre per annum plus the ground value or premium of Rs. 25 per acre, payable within five years. Mr. Chengappa's rates were then too high.

226. Therefore the question of encouraging cardamom cultivation was discussed in September 1925 by the Collector Mr. J. F. Hall, the Conservator Mr. D. T. Barry, and the District Forest Officer Mr. D. F. Stileman, and the following conclusions were arrived at :—

(1) Existing leases should be renewed or accepted on existing rentals and conditions.

(2) The policy to be adopted in future in granting cardamom leases should be—

(*a*) to encourage the granting of such leases both in the reserves and unreserves,

(*b*) to charge no purchase price or premium for the lease and to make no attempt to sell it in auction and to charge no renewal fee,

(*c*) to grant leases on fixed rentals for a period of 25 years on the principle of "first come first served."

(*d*) for the time being, the rates to be charged should be Rs. 5 per acre per annum on the Palni hills and Rs. 4 per acre per annum in the Cumbum Valley,

(*e*) for the first six years of the lease only half the above rentals should be charged in recognition of the fact that for a period varying from five to seven years no appreciable outturn can be expected from the cardamoms,

(*f*) a deposit (at approximately Rs. 5 per acre) for the cost of demarcating the lease lands should be placed by the lessee before the lease is granted,

(*g*) in each lease an option of renewal should be given but not necessarily renewal at the existing rate of rental.

The Conservator was of opinion that once the general principle was accepted it would be unnecessary to refer each lease to him.

The above policy was approved by the Chief Conservator of Forests, in his Proceedings Mis. No. 312, dated 10th December 1925.

The proposal to open the Kottamalai Hills (Cumbum Valley West) in the Cumbum range for cardamom cultivation was also approved by the Chief Conservator of Forests.

227. The conditions proposed were very attractive and the leases became exceedingly popular. From 1926 to the end of 1930 a large number of cardamom leases were granted in the Kodaikanal, Palni and Cumbum ranges; the Collector was sanctioning them. The agreements, in the case of reserves, were entered into between the District Forest Officer (for the Secretary of State for India) and the lessees, and in the case of unreserves, between the Collector and the lessees. The applicants demarcated the areas at their own cost and the deposit (at Rs. 5 per acre) collected was refunded after the demarcation was completed and agreement had been executed.

228. In 1931, considering the keen demand, Mr. Hall, the Collector, proposed to revert to Mr. Chengappa's suggestion to sell the leases in auction and to fix a uniform rental of Rs. 5 per acre per annum for 25 years for all new leases in Kodaikanal, Palni and Cumbum ranges. He also proposed to discontinue the elaborate form printed in Appendix 31 of the Madras Forest Department and Account Code, Volume II, for future leases and to adopt instead a simple conditional and terminable order for a 25 years' period, to be signed by the Collector, since such leases in the reserved forests are governed by the Crown Grants Act of 1895 and the Government of India Act. The Collector's proposals were approved by the Government in G.O. No. 1791, Development, dated 17th December 1931.

From the date of this Government Order the leases have been sold in auction and granted to the highest bidder for 25 years.

229. In G.O. No. 1454, Development, dated 10th November 1932, it was ordered that the Collector should consult the Conservator regarding the grant of each lease and that the Conservator should submit every case to the Chief Conservator of Forests. The Government also ordered that the Collector should continue to issue the orders of grant.

230. The following procedure is now followed by the District Forest Officer in disposing of applications for the lease of land in the reserved forests for the cultivation of cardamoms :—

Each application is examined as to whether—

(a) the land applied for is true evergreen forest suitable for cardamom cultivation,

(b) the elevation lies between 3,000′ and 4,500′.

(c) there is any objection in granting the area on lease from the forest or game conservancy point of view,

(d) there is any objection on topographical grounds, e.g., by reason of the ground being very steep and therefore (these being water catchment areas of paramount importance on which it is necessary to conserve the soil) unsuitable for allowing *any* form of cultivation—even cardamoms.

(e) it is necessary to construct a temporary shed in the land. The permissible purposes of such shed are—

(i) for coolies to halt for a few days,

(ii) to store tools temporarily,

(iii) to store cardamoms temporarily at crop time.

A shed is necessary only if the land is remote from villages and roads. In no case is a shed allowed in a place where it could be used as a shop.

231. The result of this policy has been a considerable increase in the number of leases granted. At the end of 1933–34, the number of leases in the Kodaikanal and Palni ranges stood as follows :—

Range.	Number of leases.	Area of leases in acres.	Amount of annual rental in rupees.
Palni	187	3,112	10,317
Kodaikanal	221	1,893	7,114
Total ..	408	5,005	17,431

The amount of premium realized on 874 acres leased out since 1932 is Rs. 19,360, i.e., an average of about Rs. 22 per acre. Since the annual rental is Rs. 5 an acre, the income from one acre of shola leased out for 25 years will be nearly Rs. 150 from areas which would otherwise be quite unproductive.

232. The cultivation of cardamoms requires the clearing of shrubs and of certain of the lower story trees, the trees in the upper story being left standing for the shade which the cardamom plants require. The cardamom plant takes the place of the understory shrubs so that the factors of the locality appear to be fully preserved.

The greatest danger to which a shola forest is subject to in these localities is *fire*, which slowly, but surely, eats into its margin, and ultimately destroys the shola, replacing it by stunted deciduous growth, *Phœnix acaulis* and tall grass. The cardamom planter naturally takes every precaution to prevent fires from spreading into his area, and he has evidently met with success. He has therefore been the most successful system of insurance against fire that we have had and one that is unique in that it gives an income of Rs. 5 an acre every year as against the annual expenditure which every other system involves.

What is still more encouraging is the fact that some planters have actually succeeded in restoring shola growth in localities in which grass and *Phœnix acaulis* had taken the place of sholas as a result of annual fires. The result has been achieved by means of succesful fire protection over a period of three to five years followed by the planting of natural seedlings of shola species. Cardamom plants have been planted under the shade which has developed as a result of these operations. Cardamoms have also been successfully grown, near Pachalur, on land which was once an open paddy flat. The flat was intersected by a system of drains, cuttings of *Erythrina lithosperma* were planted and under their shade cardamoms have been grown with moderate success.

For the reasons given above leases for the cultivation of cardamoms may be encouraged in suitable sholas, and in localities adjoining sholas which have regressed into deciduous forests as a result of annual fires.

Proposals relating to the lease of lands for cardamom cultivation will be found in Part II of this working plan.

233. *Leases for the cultivation of plantains, coffee, tea, etc.*—It was stated in paragraph 102 of Chapter III of Part I that there was great demand for land on the Lower Palnis for the cultivation of coffee and plantains. In 1924 Mr. H. R. M. Law submitted a proposal for leasing out large areas in the reserves of the Lower Palnis for this purpose. The

proposal was opposed by the Collector and was rejected by the Chief Conservator in his C.C.P. Mis. No. 3, dated 10th January 1925, on the ground that plantain cultivation, combined with coffee or not, could not protect the soil from erosion.

In the year 1917 it was found that there existed several cases of lands in the reserves of the Lower Palnis cultivated with coffee and plantains for which pattas had been granted subsequently to the forest settlement or which were pure encroachments. For the lands held on patta leases were substituted by the Collector for a period of 25 years, as also for some of the encroachments. In C.C.P. Mis. No. 193, dated 10th April 1930, it has been ordered that these leases should not be renewed when they expire, as they are against the generally accepted principle of not allowing any coffee or plantain cultivation inside reserved forests.

A number of applications were received about the year 1930 for the grant of lands within the Ampthill Downs Reserve and adjacent localities for growing tea, fruit trees and wattle, in view of the transport facilities which would be available on the completion of the Goschen Road then under construction. The question of granting lands for such purposes was discussed in detail by the Chief Conservator of Forests and on his recommendation it was decided by Government (G.O. Ms. No. 1662, Development, dated 1st September 1930) that no area in the Upper Palni reserves should be granted for the cultivation of tea as it would endanger the water-supply of the several streams that rise in them, but that a total extent of 10,000 acres of grass land may be granted for growing wattle, fruit trees or other products (excluding tea). The rest of the area, including all sholas, would be reserved for grazing and game preservation. (C.C.P. No. 7528–29, dated 14th September 1930.)

(c) The Plantations.

234. (1) *The Velancombai teak plantations.*—The trees marked for thinnings in 1918 in the 1870 Velancombai plantation consisted of 284 teak, 17 *Albizzia* sp., 4 *Mangifera indica* and 13 miscellaneous. These were auctioned for Rs. 2,220. During the execution of the thinnings, 54 teak, 4 *Schleichera* and 2 *Eugenia* trees were damaged. They were sold in 1922 along with 4 *Mangifera*, 5 *Albizzia* sp. and 5 *Terminalia belerica* trees left uncut in 1918. The teak fetched Rs. 77 and the other species Rs. 61.

For the 1921 plantation an extent of 5·38 acres of forest was sold for Rs. 40. Pits 1′ × 1′ × 1′ were dug six feet apart at a cost of Rs. 24–4–0. Nursery transplants were used in addition to dibbling of seeds, the work being completed by October. In all some 4,600 plants were planted out. Casualties were replaced in November and December 1921 as well as in September 1922. Floods in December 1922 were reported to have carried away a large number of seedlings, and an enumeration in February 1923 showed 43 per cent casualties.

The total expenditure up to 1929 was Rs. 170. In December 1933, the plantation was thinned. The number of poles removed was 61, of an average girth of 16″ and an average height of 42′. The thinnings sold for Rs. 56 at Palni : an expenditure of Rs. 8 was incurred. Part of this plantation is on swampy ground.

The 1922 plantation was raised on 5·5 acres of forest sold for Rs. 33 for clearfelling and burning : 5,450 pits were dug at a cost of Rs. 34–1–0. Though a nursery had been raised the area was completely dibbled with teak seeds for want of rains in August 1922. About 750 seedlings were planted out in October 1922. A large number of seedlings were washed away by floods in November, upon which more seeds were dibbled in December. Enumerations in January 1923 disclosed 75 per cent casualties. Attempts were made in 1925 to replace casualties by dibbling.

The total expenditure incurred on the plantation was Rs. 71–2–0 up to the end of March 1923.

(2) *The Vannathiparai teak plantations.*—The thinnings of 1919–20 from the 1869 Vannathiparai plantation were sold for Rs. 1,600 : the contractor who purchased the material gave the outturn as 4,743 cubic feet of timber (of which teak was 1,025 cubic feet) and 486 cubic feet of firewood.

In 1920–21, a portion of the plantation was successfully underplanted with *Dalbergia latifolia* : another portion underplanted with *Albizzia odoratissima* proved a failure.

In 1921–22, 37 teak trees were girdled, and extracted in 1922–23, along with another dead teak. The volume of timber thus removed was 764·5 cubic feet which was sold for Rs. 410. In 1923–24, twenty more teak and one *Dalbergia latifolia* were removed in thinnings.

For the 1920 teak plantation, 50 acres in the Vannathiparai forests were sold for Rs. 7,149 for clearfelling preparatory to planting. Pits $1\frac{1}{2}'$ cube were dug at a spacing of 8 feet. Nursery seedlings, three months old, were planted out in balls of earth in September and October 1920 over an area of 14 acres. Casualties were replaced to the end of October.

The survivals were 59 per cent in July 1922. In 1921, 30 acres of forest were sold for Rs. 3,230 for clearfelling preparatory to planting. Thirty-one and half acres were planted in pits spaced 6′ × 6′ in August to October 1921. Casualties were replaced in November 1921 and September 1922.

In 1922, 6 more acres were planted up, 6′ × 6′, in October.

The expenditure incurred on these plantations is summarized below :—

Year.	Area planted.	Cost per acre.
	ACS.	RS. A. P.
1920	14	73 12 7
1921	31½	67 10 5
1922	6	64 4 6

In recommending the discontinuance of further planting of teak in the Vannathiparai Valley, Mr. K. A. Chongappa made the following observations :

(a) The casualties were high, due perhaps to the uneven distribution of rainfall, and to its insufficiency,

(b) The cost of formation was heavy,

(c) There was no need to raise teak at Vannathiparai to meet the Cumbum market since Travancore teak was available in large quantities across the border.

(3) *The Mahogany plantation.*—The expenditure incurred on planting mahogany in 1921–22 was Rs. 25 and an equal amount was spent in 1922–23. Of the plants put out between 1921 and 1923, only nine had survived in 1933.

(4) *The Gundar Valley Eucalyptus plantations.*—The fuel coupe of one acre sold in 1923–24 in the Eucalyptus plantations realized Rs. 440. In 1926–27, 631 trees were extracted in thinnings from Compartment XI and sold at Re. 0–12–0 per tree. In 1929–30, 1,593 trees in Compartments XI and VII were marked for extraction in thinnings and sold at Rs. 1–14–0 each, but the contractor could not find a sale for more than 500 trees, owing to competition from trees in patta lands, and consequently the contract was cancelled after the removal of the 500 trees.

The following statement gives the result of operations between 1921–22 and 1928–29 :—(Nothing was done between 1916 and 1921).

Year.	Quantity of wood removed in cubic feet.	Revenue realized.	Remarks.
		RS. A. P.	
1921–22	20	0 5 0	
1922–23	1,931	70 0 0	
1923–24	1,844	522 0 0	One acre coupe felled.
1924–25	663	41 7 0	
1925–26	786	49 2 0	
1926–27	608 } 32 }	75 0 0	32 cartloads of leafmould sold.
1927–28	1,489	122 0 0	
1928–29 .. .. }	2,800	179 0 0	
1929–30 .. .. }		800 0 0	Thinnings.

Further thinnings in this plantation were stopped as it was considered more important to find a sale for the dead pine in the pine plantations.

(5) *The Poombarai Wattle plantation.*—Dead wood from the Poombarai Wattle plantation appears to have been sold about the year 1921 : the amount realized could not be traced out.

(6) *The Kodaikanal pine plantations.*—In 1923–24, an attempt was made to grow a belt of Australian wattle along the fireline from the golf links towards Kaluthaviduthi. Beds 3′ × 1′ spaced every ten chains were sown with *Acacia* seeds, with unsuccessful results. In 1924–25 the casualties were replaced with stumps but the operation was done too late in the year. In 1925–26 stumps were used again over a distance of 6 miles, but in the month of June. This time the failure was due to want of rain. Operations were repeated in 1926, 1927 and 1928 and the seedlings protected against frost with bracken, but no substantial results were achieved.

The further history of *Acacia* firebelts round the pine plantations will be found under ‘ Fire protection ’ in paragraphs 269 to 272.

(*d*) The Cumbum Valley.

235. *Fuel.*—The results of management of the fuel series from the year 1916 are given below :—

(1) *Suranganar series.*—Rotation 30 years. Since coupes XV to XVII were located in the timber area adjacent to the Kumli ghat road, sanction was obtained to eliminate them from the Fuel Working Circle. Coupe XVIII was therefore worked in 1916–17 instead of Coupe XV. Coupes XIX to XXIII were worked regularly from 1917–18 to 1921–22. Arrears in coupe XXII were worked in 1922–23. Coupe XXIV was worked in 1923–24 and part of coupe XXV in 1924–25. The balance of coupe XXV and coupe XXVI were worked in 1925–26. Coupe XXVII was worked in 1926–27 and 1927–28 and coupes XXIX and XXX in 1928–29 and 1929–30, respectively. In place of coupes XV to XVII eliminated as noted above, three coupes were worked in the Kappuvamadai Reserved Forest in 1930–31, 1931–32 and 1932–33. Since the growth in this reserve is of the scrub type, the coupes were felled under the 'simple coppice' system with proper sanction.

The felling series consisting of 30 coupes thereby completed its first rotation at the end of 1932–33.

An examination of the standards retained in the first rotation was made in 1933, when it was found that many of them had been stolen by the timber smugglers for which this valley has long been notorious. It was therefore decided, in consultation with the Working Plans Branch, to adopt thereafter the simple coppice system for all the fuel series in the Cumbum range, in place of the Coppice with Standards system. Coupes I to III have been worked accordingly from 1933–34 to 1935–36, in the second rotation.

Coupes excluded in the past rotation as areas bearing timber will be included in the Timber Working Circle : suitable fresh areas will be added. The coupes in Kappuvamadai Reserved Forest will be added to a new fuel series to be formed.

(2) *Surulipatti series.*—Rotation 30 years. Coupe XI was worked in part in 1916–17 and the balance completed in 1918–19. Coupe XIV was worked in 1919–20 and 1924–25 and Coupe XV in 1920–21 and 1922–23. Coupe XII was worked in 1921–22 ; Coupe XVI in 1922–23 ; Coupes XIII and XVII in 1923–24. Coupes XVIII to XXX have been worked regularly from 1924–25 to 1935–36 except for small arrears in coupes XXI, XXIII, XXIV and XXV which were worked in the years subsequent to the respective regular fellings. Coupes XXVIII to XXX were worked under the 'Simple Coppice' system [vide paragraph 235 (1) above].

This series will enter its second rotation in 1936–37.

Old Coupes I and II will be deleted and suitable areas near Coupes XXIX and XXX will be added to make up the loss. About 20 acres will be allotted for planting *Eriodendron*. Suitable additional areas will be added which will not greatly dislocate the coupes of the first rotation.

(3) *Kombai series.*—Rotation 30 years. Coupes XII to XVI were worked regularly from 1916–17 to 1920–21. Coupes XVII and XVIII were considered to be unworkable. Coupe XIX was worked in 1924–25, a small part of it being worked in 1925–26 as an arrear. Coupe XX was worked partly in 1925–26 and the balance in 1926–27. Coupe XXI was worked in 1926–27 and Coupe XXII in 1927–28 and 1928–29. Coupes XXIII to XXX have been worked regularly from 1928–29 to 1935–36. Coupes XXVIII to XXX were worked under the "Simple Coppice" system [vide paragraph 235 (1) above]. This series will also commence its second rotation in 1936–37.

Old coupes I and II will be deleted as they bear very little growth. Suitable areas have been added to enlarge the series.

(4) *Machakal series.*—Rotation 30 years. Coupe VIII prescribed for felling in 1916–17 was not worked. Coupes IX to XX were worked regularly from 1917–18 to 1928–29, a small arrear in the last mentioned coupe being felled in 1929–30. Coupes XXI to XXVII have also been worked regularly from 1929–30 to 1935–36, the last three coupes being under the 'Simple Coppice' system [vide paragraph 235 (1) above].

(5) *Pudupatti series.*—The first coupe in this new series was worked in 1916–17, but coupe II did not find a sale in the next year. Part of coupe III was felled in 1918–19, and the balance was written off. No coupes were sold between 1919 and 1926, most probably due to poverty or growth in the succeeding coupes. The order of felling was then changed and coupe XXX was worked in 1927–28 and 1929–30. Coupe XXIX was worked in 1928–29 and 1930–31. Coupes XXVIII to XXII have been worked in that order, regularly, from 1929–30 to 1935–36. This series has been worked under the 'Simple Coppice' system from the beginning. The series will be reformed by deleting large blanks and adding parts of Pannimuthukaradu and Kombai reserves.

236. *Timber.*—The fifty dead and dying trees of teak, *Pterocarpus marsupium* and *Terminalia paniculata* sold in 1932–33, standing, from the Melgudalur reserve fetched Rs. 1,100 in auction. The contract resulted in considerable illicit fellings. No more timber sales were effected.

237. *Bamboos.*—One coupe in each of the four bamboo felling series was worked every year from 1918–19 to 1925–26. Only one coupe was sold in 1926–27 as the other series contained no saleable bamboo. No bamboos were sold from 1927–28 to 1932–33, as there was a general flowering in 1926–27. One bamboo coupe has been sold every year from 1933–34, in accordance with the scheme prepared by Ranger K. C. Joseph.

238. *Cardamoms.*—The total number of leases granted up to the end of 1933–34 was 43, covering an area of 817 acres, with an annual rental of Rs. 2,254.

(*e*) The Trichinopoly District—Kulittalai Taluk.

239. The following coupes were worked in 1916–17 :—

Viramalai I.—Coupe XI.
Viramalai II.—Coupe XI.
Puthanatham.—Coupe XI and arrears of Coupe X.
Karpur-Reddiapatti North.—Coupe XXI.
Karpur-Reddiapatti South.—Coupe XXI.
Semmalai.—Coupe XXI.
Sorupam.—Coupe XIV.
Panjanthangi Hill.—Coupe XXI.
Kumarikatti.—Coupe XIII.
Sigamkaradu.—Coupe XV.
Mogavanur.—Unworked portions of Coupes VII and VIII, (completing the series and the reserve.)

240. In 1916–17 it was found that the whole of Semmalai I, Methalamalai, Puthanatham, Mogavanur and Panjanthangi Valley reserves and appreciably more than what was estimated in Sorupam, Minnakaradu and other reserves, had been felled over. The result was that there were no longer sufficient areas to be felled in accordance with the Working Plan. This was caused by laying out coupes of larger areas than those prescribed, and by errors in the calculation of the total areas of reserves.

The actual areas worked over were surveyed and the areas of reserves recomputed in 1916. The rotation of 25 years was considered insufficient and it was proposed to raise it to 40 years. The revised prescriptions regrouped the felling series and prescribed fellings for the balance of the area left over.

241. The following felling series emerged from this revision :—

(1) *Viramalai I* and *II* were clubbed together and the rotation was raised to 40 years. Twenty nine coupes were demarcated for the balance of the rotation.

(2) *Karpur-Reddiapatti, North and South, Kumarikatti* and *Sigamkaradu* were combined into one, the rotation was raised to 40 years and 19 coupes were formed out of the unfelled area, for the rest of the rotation.

(3) *Semmalai* and *Puthanatham* were clubbed together, the rotation was raised to 40 years and the unfelled area was divided into 19 coupes.

(4) *Sorupam* and *Panjantangi* were clubbed together and the unfelled area was divided into ten coupes. The rotation was to be raised to 40 years by allowing rest for nine years.

These deviations were sanctioned in B.P. Mis. Forest No. 216, dated 31st March 1919.

242. The coupes worked in the four series formed in 1916–17 are detailed below :—

(1) *Viramalai I* and *II.*—No coupes were worked in 1917–18 and 1918–19. Coupes XII to XVI were worked regularly from 1919–20 to 1923–24. Again, no coupes were felled from 1924–25 to 1926–27. Coupes XVII and XVIII were, however, worked together in 1927–28, coupes XIX and XX in 1928–29 and coupes XXI and XXII in 1929–30. Coupes XXIII and XXV were worked from 1930–31 to 1932–33 and there was no work in 1933–34. Coupes XXVI and XXVII have been worked for 1934–35 and 1935–36, respectively.

(2) *Karpur-Reddiapatti.*—No coupes were worked in 1917–18 and 1918–19. Coupes XXII to XXXV were worked regularly from 1919–20 to 1932–33. No coupe was sold in 1933–34. Coupes XXXVI and XXXVII were worked in 1934–35 and 1935-36, respectively.

(3) *Semmalai.*—No coupes were worked in 1917–18. Coupes XXII to XXXI were worked regularly from 1918–19 to 1927–28. Coupes were also felled every year from 1928–29 to 1932–33 in the old Puthanatham series combined with this series in 1916–17 : but

instead of numbering them in continuation of the coupes in the new series (as XXXII to XXXVI) they have been numbered in continuation of the old series, as XII to XVI. No coupe was sold in 1933–34. Coupes XVII and XVIII of the old series (XXXVII and XXXVIII of the new series) were worked in 1934–35 and 1935–36 respectively.

(4) *Sorupam.*—There was no felling in 1917–18. Coupes XIII to XI were felled in that order from 1918–19 to 1920–21. Then Coupes XXV to XXXI were felled regularly from 1921–22 to the end of 1927–28. The prescribed rest of nine years will lapse by 1936–37.

SECTION 3.—GRAZING.

243. *General.*—A reference to the general history of the forests of the Madura division (Section 1 of this Chapter) will show that with the advent of forest settlement in 1890 grazing fees were levied on cattle, goats and sheep admitted into reserved forests.

The first working plan was prepared for the fuel ranges of the Madura district in 1900, and this provided specifically for the grazing of cattle and the *browsing of goats*. The result was serious denudation of the forests though the grazing revenue leapt up from Rs. 3,000 in 1895 to Rs. 30,000 in 1905. A similar prescription was embodied in the Working Plan for the Cumbum range sanctioned in 1901, which resulted in similar effects.

These two Working Plans were revised in 1907 and 1912, respectively. The revised plans prescribed, fortunately, the total exclusion of goats from all reserves.

The rates of grazing fees then in force appear to have been :—

	RS.	A.	P.
Sheep	0	2	0
Cows	0	4	0
Buffaloes	0	8	0
Goats	0	4	0

244. *Sholavandan, Natham and Aiyalur ranges.*—When Mr. C. C. Wilson prepared the Working Plan for the fuel forests of the Madura district (1916) it was recognized that a considerable reduction should be effected in the number of cattle admitted for grazing into the concerned reserves (Reserves of Sholavandan, Natham and Aiyalur ranges, excepting that part of Aiyalur range which lies in Trichinopoly district) and that sheep should be excluded altogether, in order that the forests might be in a condition fit to serve the primary object of supplying firewood to Madura town. It was found that, in 1914–15, 26,814 cattle and 33,712 sheep grazed in the area covered by the plan, the effective incidence of grazing being about 1 cow unit for less than 2 acres, which was indeed very high. Therefore the fee for sheep was raised gradually until it was 8 annas in 1922, after which sheep were entirely excluded from these reserves and the fee for cattle was raised gradually to Re. 0–12–0 a cow unit between 1917 and 1922. The number of cows and bulls that grazed in this area every year for the period 1933–35 was only 14,529, on the average. The area available for grazing has been reduced from 144,930 acres to 137,005 acres by the transfer of areas to other ranges and to panchayat management. There has therefore been a very desirable reduction, from 43,670 cow units in 1914–15 to 14,529 in 1934–35, in the cattle that graze in the reserves of Sholavandan, Natham and Ayyalur (Madura) ranges, whereas the area of the ranges has been reduced from 144,930 acres to 137,005 acres only and sheep have been entirely excluded. The grazing incidence is thus about 1 cow for 6 acres, where it may stand for the future.

245. In B.P. Forest No. 73, dated 7th July 1917 a grazing scheme was sanctioned for the area covered by Mr. Wilson's Fuel Working Plan and the Palni range. The scheme allotted specified blocks to villages in order to fix responsibility for fires, and closed the Oliyanuthu, Velancombai, Vennilai, Siruvatkad, Umayur, Kanienkad and Kaduguthady reserves of Palni range permanently to grazing. Except for the closure of the reserves named above this scheme never came into force.

246. *Aiyalur* (*old Vyampatti*) *range.*—For that part of Aiyalur range which lies in the Trichinopoly district, the Working Plan sanctioned in 1909 prescribed the strict exclusion of goats from all reserves. In 1907–08 the total number of cow units which grazed in the forests was 5,860 (including 2,909 sheep) which gave an incidence of 1 cow for 2·84 acres. The grazing fees were raised in G.O. No. 275, dated 12th February 1924, to the following rates :—

	RS.	A.	P.
Sheep	0	8	0
Cows	1	0	0
Buffaloes	2	0	0

The average number of cattle which grazed in these forests annually for the period of five years ending with 1934–35 were only 3,532. This has decreased the incidence to 1 cow unit for 4·75 acres, which is quite satisfactory.

247. *Kodaikanal range.*—In the major part of Kodaikanal range, however, the rates fixed in G.O. No. 3385, dated 5th July 1897, continue to prevail, i.e.—

	RS.	A.	P.
Sheep	0	2	0
Cows	0	4	0
Buffaloes	0	8	0

(It is probable that goats were excluded from these reserves about the year 1912.) In the Tambirankanal and Agamalai reserves transferred to this range from the Sholavandan range in 1924 the higher rates that are current in the latter range are in force.

The number of cattle that purchased permits for grazing during the last five years is given below :—

Year.	Cows and bulls.	Buffaloes.	Sheep.	Total in cow units.
1930–31	5,000	59	4,664	7,450
1931–32	3,873	139	4,226	6,264
1932–33	4,049	141	4,246	6,454
1933–34	4,220	189	3,460	6,328
1934–35	4,605	282	2,772	6,555

In addition to the cattle which graze under cover of permits, the villagers of the Upper Palnis have been permitted by Government to graze all their cattle *free* in the Ampthill Downs reserve. The number of cattle which have been grazed free under this concession between the years 1930 and 1935 have averaged 6,500 cow units annually.

A general review of the existing conditions of grazing shows that the rates of grazing fees in the various ranges are not uniform, nay, they even differ within the range as in the case of Kodaikanal and Aiyalur ranges. It was, therefore, proposed in 1923 to raise the fees in the Kodaikanal range, gradually in three years, to the level that prevailed over the rest of the division, but it was directed that the question should lie over pending the decision of Government on the general question of enhancement of grazing fees in the Presidency.

The matter was taken up again in 1926 when Government ordered (in G.O. Mis. No. 880, Development, dated 17th June 1926) that grazing should be permitted in an entire range on a single permit. On this the Chief Conservator observed that the Government were not likely to entertain any proposal to raise the grazing fees just then in view of the unfavourable season but that the question of enhancement would be considered in connexion with the Government Memorandum No. 2248-1-26/2, dated 17th September 1926, communicated in Chief Conservator's Reference No. 7226/26, dated 1st October 1926. In reply to this it was again recommended that the grazing fees in the Kodaikanal range should be raised to annas 6 for sheep, annas 12 for cows and Rs. 1–8–0 for buffaloes (the rates that prevail in other parts of the Madura district). No orders were received on this. The question was brought before Government in 1932, for the third time.

In G.O. Mis. No. 802, Development, dated 11th June 1932, it has been ordered that grazing permits should, in future, be made valid for the whole of a forest division on payment of the highest rate fixed for any range in the division. Taking this order together with the one which permitted grazing in an entire range on a single permit, it is clear that the policy of Government is to simplify the issue of grazing permits and that uniformity is the ultimate object. The case for raising the grazing fees in Kodaikanal range to the level that prevails over the rest of the Madura district is therefore very strong.

248. *Palni range.*—We may presume that goats were excluded from the reserves of Palni range about the year 1912, when they were excluded from other reserves in the district.

The rates for grazing were raised in 1921 to 6 annas per sheep, 12 annas per cow and Rs. 1–8–0 per buffalo, under the same Government Order which raised them in the Cumbum range. The numbers of cattle that grazed in the reserved forests of the range during 1933–34 and 1934–35 are given below :—

	1933–34.	1934–35.
Buffaloes	11	7
Cows and bulls	3,514	3,718
Sheep	965	826

or an average of 4,145 cow units annually.

The following reserves, of a total area of 29,920·40 acres, are permanently closed to grazing, under B.P. Forest No. 73, dated 7th July 1917 :—

Name of the reserve.	Area in acres.
Oliyanuthu	4,352·00
Velancombai	166·40
Vennilai	5,746·00
Siruvathukad	3,070·00
Umayar	486·80
Kanienkad	2,495·00
Kaduguthady	369·00
Kudaraiyar	13,235·20
Total ..	**29,920·40**

So far as the hill villages on the Lower Palnis are concerned (Pachalur, Periyur, Vadakadu, Kilakkuchettipatti, Thandigudy and Pulathur) their cattle are limited in number and they have ample areas in the patta lands, unreserves and reserves open to grazing in the Palni and Kodaikanal ranges.

As for the villages in the plains adjoining the northern slopes of the Palni Hills, in the Palni taluk, about 8,000 acres out of the 11,575 acres of the Northern Slopes Reserved Forest and 12,000 acres of the Karadikuttu and P.V. Valley reserves, i.e., a total of 20,000 acres, are actually accessible for grazing. The average number of cow units from the plains that grazed in these reserves for the last two years was only 2,600. The latest (January 1935) cattle census figures for the plains villages that habitually graze their cattle in the reserves of Palni range disclose the existence of about 5,500 cows in them. A liberal quota of grazing grounds is therefore available for the cattle that resort to the reserved forests in the Palni range ; indeed more cattle can safely be admitted.

There are vast areas of zamindari forests in this range adjoining our reserves—Rettaiyambadi, Ayakudi, Velur, Kannivadi, etc. to which a considerable number of non-zamindari cattle resort for grazing. There is therefore no dearth of grazing grounds in the Palni taluk.

249. *Cumbum range.*—In the Cumbum range, the following number of cattle and goat were reported to have grazed in 1912, soon after which goats were excluded from reserves :—

Cows	23,380
Buffaloes	220
Sheep	6,922
Goats	2,219

The rates for grazing were increased in G.O. Mis. No. 1063, Development, dated 16th June 1921, to 6 annas for sheep, 12 annas for cows and Rs. 1–8–0 for buffaloes.

The following number of cows and bulls grazed annually in the reserves of the Cumbum range between 1930 and 1935 :—

1930–31	4,549
1931–32	4,418
1932–33	4,550
1933–34	4,930
1934–35	5,072

i.e., an average of 4,704 cows every year.

From 23,380 cows in 1912 to 5,072 cows in 1934 is a drop which calls for explanation. It is not due to any large decrease in the number of cattle in the villages adjoining our reserves : the cattle census of January 1935 gives the following statistics :—

	Village.	Adjoining reserved forest.	Number of cows and bulls.
1	Kombai	Kombai	2,838
2	Pannappuram	Do.	2,319
3	Melgudalur	Machakal, Suranganar, Melgudalur	3,592
4	Keelagudalur	Kappuvamadai, Vannathiparai	2,660
5	Cumbum	Kombai, Machakal	1,662
6	Uthamapuram ..	Kombai	3,828
7	Pudupatti	Do.	1,814
8	Hanumanthampatti ..	Kombai and Pannimuthankaradu	1,561
9	Uthamapalayam ..	Do.	3,304
10	Narayanathevanpatti.	Vannathiparai, Surulippatti, Puvuthukaradu, Buthakaradu.	2,176
11	Kamayagowndanpatti.	Surulipatti, Buthakaradu, Dhonikaradu	1,901
		Total ..	**27,660**

The rise in the grazing fees and the prohibition of penning cattle inside the reserves have driven the cattle away into the Travancore State and to the Gandamanayakanur zamindari forests, where the rates are lower and penning is permitted.

250. *Penning.*—The existence of localities with names indicating pens goes to show that penning of cattle inside the forests must have prevailed prior to reservation, but no penning inside reserved forests appears to have been permitted after reservation until 1923. In 1923 pens were opened in the Cumbum range, on the recommendation of Mr. Chengappa, on condition that the forests should be protected from fire. This concession was withdrawn in 1926 as the forests continued to be burned as before.

In 1930 permission was granted for one year for penning cattle near Vattathotti in the Cumbum range provided that the grassy area in the locality be early burnt in December after isolating it from the surrounding forests by a scraped line 12 feet broad.

In 1932 Mr. B.J. Singh recommended the opening of pens in the Cumbum range when submitting a reply to a query from Government regarding penning of cattle in reserves.

It was pointed out in paragraph 249 above that a very large number of cattle were resorting to the Travancore State forests and to the Gandamanayakanur zamin forests partly on account of the prohibition of penning cattle inside our reserves. This has resulted in a large diminution in the number of cattle that graze in the reserves of the Cumbum range, with the result that our grassy areas are undergrazed which is one reason why fires in this range are more common and more destructive than in the other ranges. Cattle are penned in the Travancore forests in pens some of which almost touch the common boundary ; they have permits to graze in our forests ; there is almost unlimited grazing on the Travancore side and fire protection is not intensive. The result is that fires from Travancore cross over the frontier (which is not being fire-traced) into our reserves, where the grass is high as a result of undergrazing combined with annual fires. Since some of the pens almost touch the common boundary, we do not escape the evil effects of penning, but since we do not allow any penning we gather none of its advantages ! The opening of a few suitable pens in our reserve will attract some of these cattle into them and will help to keep down grass (and therefore the intensity of fires) and add to our revenues at the same time. The demand for pens is keen. Proposals for opening pens in Cumbum range will be found in Chapter XI of Part II.

There is no particular demand for pens any where else in the division.

SECTION 4.—FIRE PROTECTION.

251. *General.*—One of the first measures of improvement that were taken up after the organization of the Forest department in this district was fire protection. Elaborate systems of fire lines were laid out over the Alagar Hills reserve and considerable sums of money were spent on fire patrols and in clearing and burning the lines every year ; reports disclose that satisfactory results were achieved. Though this system was abandoned for the most part before 1900, some of the old lines are still noticeable on the ground in the Alagar Hills.

This method of fire protection prevailed largely in pre-working plan days, i.e., up to about 1900.

Sholavandan, Natham and Aiyalur ranges.

252. Mr. Porter's working plan of 1900 for the Kanavaipatti and Palamedu ranges prescribed the discontinuance of the "enormous number of lines" then in existence, but fuel coupe lines were to be kept clear. Mr. Bryant's revised plan of 1912 prescribed that special fire protection should be extended to the Waguthumalai and Sirumalai reserves.

253. Except for the free removal of grass from areas closed to grazing Mr. Thornton's plan of 1909 did not prescribe any further measure of fire protection for the Vyampatti forests of the Aiyalur range.

254. In 1916 Mr. Wilson's Working Plan prescribed that—

(1) fuel coupes should be fire-protected by keeping the coupe lines cleared or by fire-lines 20 feet broad, so long as they are closed to grazing,

(2) no minor produce should be sold in the Sirumalai, Karandamalai and Thopaswamimalai reserves as collectors of such produce were found to cause most of the fires,

(3) the boundary line dividing the Sirumalai, Thopaswamimalai and Andipatty reserves from the adjoining zamindari forests should be permanently demarcated to a width of 20 feet and burnt to a width of 40 feet before the end of January, and that

(4) the more important foot-paths running from the plains up to hill villages should be fire traced to a width of 20 feet on either side.

255. This system continued till 1922–23 in which year "early burning" was introduced in its place on the strength of a resolution passed in the Conservators' conference of June 1922 (Chief Conservator's Proceedings No. 27, dated 13th July 1922). Formal sanction for this deviation was obtained in 1930.

Details of the fire-protection measures that prevailed in these three ranges from this time up to 1933–34 are given below :—

Sholavandan Range.

		RS.
1	Early burning lines 100 feet wide along the common boundaries between zamindari forests and Andipatty, Waguthumalai and Sirumalai reserves, 34½ miles at Rs. 4 per mile	138
2	Early burning grassy areas in the Waguthumalai Reserved Forest	2
3	Early burning 20 feet on either side of foot-paths going up to villages on the Sirumalais, 9 miles at Rs. 2 a mile	18
	Total ..	158

Aiyalur Range.

1	Early burning the common boundary in Thopaswamimalai Reserved Forest, 6 miles at Rs. 5 a mile	30
2	Early burning of grassy portions of Thopaswamimalai Reserved Forest ..	20
3	Early burning of grassy portions of Mudimalai Reserved Forest	20
4	Early burning of grassy portions of Semmalai Reserved Forest	10
	Total ..	80

Natham Range.

1	Early burning of 15 miles of old fire lines at Rs. 4 a mile on the Alagar Hills ..	60
2	Early burning of grassy patches on the Alagar Hills	40
3	Early burning of paths going up to the Karandamalai plateau, 11½ miles at Rs. 4 a mile	46
4	Early burning of grassy patches on the Karandamalais	100
5	Contingencies	4
	Total ..	250

256. In Chief Conservator's Proceedings No. 23, dated 26th April 1920, the Karandamalais were opened to the collection of all minor produce except gallnuts, as about Rs. 4,000 were being lost annually on account of the closure without any corresponding advantage.

257. In 1934 and 1935 the fire protection of the Sholavandan range was continued on the same lines as detailed above. No fire-protection work was carried out in the Aiyalur range. In the Natham range, the expenditure was reduced to Rs. 150 per year by cutting out the amount of Rs. 100 provided for early burning of the Karandamalai plateau.

258. The results of these measures may be gathered from the firemaps maintained in the District Forest Office. In the Sholavandan range, the Sirumalai, the Waguthumalai and the Andipatty South reserves exhibit the largest number of fires. On the Sirumalais, the localities where fires have been most frequent are the upper slopes above Konapatti and Valayapatti and along the path up the Tadaganachi valley.

In the Natham range the Perumalais have suffered most, the centres being along the paths from Lingavadi to Malayur and from Lingavadi to Sathambady and around the Malayur enclosure. The Alagar temple is a source of danger in the Alagar Hills Reserve.

Fires in Aiyalur range have been negligible.

The measures in force have been generally effective except that the paths not now fire-traced have been centres of danger : these therefore require to be fire-traced. The early burning on the Karandamalais has caused considerable injury to young sandal occurring naturally on the plateau, and will have to be replaced by a suitable system. In the Aiyalur range, early burning of the common boundaries in the Thopaswamimalai and Semmalai reserves may be continued.

Cumbum Range.

259. For the Cumbum range Mr. Porter's plan of 1901 did not propose any fire lines as they were considered to be useless where villagers were in the habit of setting fire to grass for the sake of grazing, but *prompt closure to grazing* for a minimum period of one year was to follow incendiary fires, a very salutary and practical prescription. Fires from the Travancore forests were to be kept out by the Travancore State ! but the common boundary was to be kept open jointly.

260. Mr. Bryant's revised plan of 1912 prescribed the protection of fuel coupes closed to grazing by lines 50 feet wide and of the timber compartments by lines 100 feet wide, against the Travancore fires. This prevailed till 1922 when grass cutting on the lines was dropped but they were "early burnt" for the first time. The results were encouraging and the method was cheap, so that it was continued in lieu of cutting the grass prior to burning. All rights of way leading to Travancore, including the Kumli ghat road, were also fire-traced. The sandal area in Kombai reserve was brought under special fire protection by means of cut lines in 1929–30, as well as the teak plantations and experimental plots in the Vannathiparai Valley. As prescribed in Mr. Khan's scheme the Surulipatti plateau was also brought under special protection in 1930–31. The fire tracing of the common boundary between the Travancore and the Madras Forests was, however, given up in 1931–32, since Government did not consider it necessary to keep the frontier boundary open and in this region of high grass the width of the line was insufficient effectively to prevent fires from getting across.

261. The following fire-protection measures were in force from 1931 to 1935 :—

	RS.	A.	P.
1. Fire tracing a 50 feet wide line on three sides of the Surulipatti plateau, $11\frac{1}{4}$ miles at Rs. 20 a mile and two fire patrols for two months at Rs. 10 each a month	265	0	0
2. Fire tracing 50 feet wide line round the Kombai sandal area and the Vannathiparai teak plantations and Experimental plots, 3 and 3/20 miles at Rs. 16 per mile	50	7	0
3. Fire tracing 12 miles of rights of way at Rs. 16 a mile	192	0	0
4. Fire patrol, 1 for 2 months at Rs. 10 a month, on the Kumli ghat road	20	0	0
Total ..	527	7	0

or about Rs. 530.

262. The results of these measures have not been encouraging. Extensive areas have been burnt almost every year adjoining the Travancore frontier by fires crossing from the Travancore State forests which are being set fire to every year without let or hindrance. We have not been clearing the frontier boundary since 1931–32 and this facilitates the spread of Travancore fires into our forests. The fire tracing of the rights of way does not help to keep out the fires from across the frontier. Fires have also been common in the Kombai Reserved Forest and on the Surulipatti plateau. Since the Surulipatti plateau is under special fire protection the extensive fires noticed therein must presumably have been caused only by graziers and collectors of minor produce.

No fires can be tolerated in future on the Surulipatti plateau where plantations of teak are being prescribed. Prescriptions for future fire protection will be found in Chapter XI of Part II.

Palni Range.

263. In the Palni range, the boundaries of the P.V. Valley, Olianuthu and Kudirayar reserves were fire traced annually up to and including 1921–22. The cost was about Rs. 350 per annum. No other areas were under special fire protection. In 1922–23 this system gave place to "early burning" under which the annual expenditure was about Rs. 100 or less. "Early burning" continued till 1930 when Mr. J. A. Master prepared a more elaborate scheme, which was in force from 1930–31 to 1933–34. Under this scheme, two miles of the common boundary between Kudiraiyar reserve and Rettaiyambadi mitta, 2 miles of the common boundary between the Madura and Coimbatore districts, and 18 miles of rights of way, were fire traced to a width of 50 feet and 26 miles of the southern boundaries of the Kudiraiyar, Olianuthu and P.V. Valley reserves, abutting on the unreserves of the Palni plateau, were early burnt. The estimated average annual cost was Rs. 350. In 1934–35, the last mentioned item was cut out, resulting in a saving of Rs. 130. The rest of the work was carried out as previously.

264. A perusal of the past statistics of fire protection in this range does not disclose encouraging results. The grassy plateaux of the Lower Palnis are subject to almost annual fires probably caused by graziers and collectors of minor produce, but these forests are essentially of the *Terminalia chebula* type and have not therefore suffered noticeably. The Kudiraiyar reserve (closed to grazing) is a better type of timber forest and was free from extensive fires till 1934, but 1,153 acres were reported to have been burnt in that year in eight fires: one of the fires crossed northwards from the grassy downs of the Upper Palni unreserves and swept over 400 acres. Protection against this appears therefore to be necessary. It is also desirable to prevent incendiarism by graziers.

The Kodaikanal Range.

265. From the year 1895 the reserves of Kodaikanal range adjoining the plains—Adukkam, Amburuvi, Karungal Dhonimedu, Pambar and Iruttar—were protected against fire by cutting and burning their boundaries to a width of six feet to twelve feet. This system appears to have been continued without material alteration till 1921. From 1922–23 "early burning" was substituted for cutting and burning the lines, thus effecting considerable savings. From 1924–25, the main motor ghaut road and the coolie ghaut road were fire traced every year by "early burning". The common boundaries between the various zamindaris and the reserved forests were fire traced occasionally, e.g., the Bodinayakkanur—Agamalai boundary in 1924–25 and the Ayakudi—Perumalmalai boundary in 1929–30.

266. In 1930–31 Mr. J. A. Master prepared a scheme of fire protection which has been in force up to date, without material alterations.

Under this scheme the Southern Slopes and Pambar reserves are being protected by cutting lines six feet wide on either side of eight miles of the Kodaikanal motor ghaut road and four miles and three furlongs of the "coolie" ghaut road and burning away from them to a width of 100 feet. This costs about Rs. 108 every year. Other fire protection measures under this scheme were confined to the Upper Palnis, the details of which will be found in paragraph 287 below.

The Kodaikanal Pine plantations.

267. The pine plantations at Kodaikanal were protected against fire from the time of their formation (1906–1915) up to 1920 by means of a scraped line 12 feet wide running all round their exterior; grass was burnt between this and a guide line cut about 100 feet away, so as to form a 100 feet burnt line all round. This cost about Rs. 350 per annum.

XXX

268. The disastrous fire of 1920 [vide paragraph 166 (6)] destroyed about half the total area of the pines planted. Interior block lines were therefore introduced in 1921 in order to secure better protection. In 1922–23 a modified form of early burning was adopted under which the old lines were not cleared but grass outside them was burnt "early." This was not satisfactory as the fire often got out of control and burnt patches of the pine, so that the system of clearing the lines before burning was reintroduced in 1927–28.

269. As a measure of further protection Messrs. Cox and Wood decided in 1921 that the remnants of the pine plantations should be protected against fire by a live belt of *Acacia decurrens* or *Acacia dealbata*, one chain wide, to be established all round their periphery inside the outer fireline, and by planting up the interplantation spaces with the same species. This work was started in 1921 and a belt, one chain wide and three miles seven furlongs long round a part of Block I of the plantations, was sown in that year. This belt was extended in the next year by a length of two miles and one furlong, so as to go completely round Block I (except for a small bit from the old Golf house to the Pillar Rocks). The results were not encouraging. In 1923, therefore, work was confined to the resowing of four furlongs on the northern side of the block by the subordinates. The Chief Conservator (Mr. Tireman) inspected the work in 1924 and ordered the experimental *planting* of *Acacia dealbata* in the blanks. This was done unsuccessfully in 1924.

In 1925, *stumps* were planted out, in four rows, at an espacement of 6′ × 6′: about 25 per cent of these are reported to have survived.

In 1926, casualties in the belts of 1921–22 and 1922–23 were filled up with stumps of *Acacia dealbata* and seeds of *Acacia decurrens*. In addition, three parallel lines one foot broad and six feet apart were scraped all round Block II and seeds of *Acacia decurrens* were sown broadcast over a length of fourteen miles four chains. The results were not satisfactory, seeds having been washed away by heavy rains.

In 1927, all blanks round Block II were dibbled with *Acacia dealbata* in shallow pits in three rows. A success of 50 per cent was achieved.

In 1928, blanks round Block I were planted with stumps of *Acacia dealbata* and those round Block II with seeds of *Acacia decurrens*.

In 1929, Mr. Whitehead inspected the work done in connexion with these *Acacia* firebelts and recommended that seeds be sown on mounds in the block lines and on turf cut one foot square and turned upside down. The shallow pits resulting from the removal of turf were to be planted up with seedlings. Experimental sowings on these lines met with considerable success and were considered to be satisfactory by the Chief Conservator, on his inspection in 1930, when certain modifications were suggested by him.

In 1930–31, the operations were carried out in accordance with the modifications suggested but the casualties were heavy owing to frost and drought.

In 1931–32, 570 chains were treated round the pine plantations, plants raised in the nursery being put out in baskets and seeds dibbled in prepared soil in trenches and on mounds. The total cost of the operations was Rs. 563–8–0. Germination of the dibbled seeds was good. The results were far more promising than those of the previous year, as a result of soil preparation, but large gaps have to be resown. No further *Acacia* sowings were done round the pine plantations after 1931–32.

270. The expenditure on the creation of a protective belt of wattle has been as follows:—

Year.	*Cost.*
	RS.
1921–22	822
1922–23	280
1923–24	2
1924–25	71
1925–26	119
1926–27	344
1927–28	187
1928–29	220
1929–30	958
1930–31	649
1931–32	564
1932–33	16
1933–34	Nil.
Total	4,232

271. The result of these operations is a scattered growth of *Acacia decurrens*, with a sprinkling of *Acacia dealbata*, round Block I, to an average width of four rows; it is only in a few places that the line is continuous and really fire-proof. The average height of these trees is about 30 feet. Round Block II there are survivals in about a third of the pits scattered along the lines.

272. The expenditure incurred in fire protecting the pine plantations since their formation is given below: (the expenditure on the formation of an *Acacia* belt has been included).

Year.	*Cost.* RS.	A.	P.
Prior to 1921–22 at Rs. 350 a year.	3,500	0	0
1921–22	2,697	10	8
1922–23	734	4	6
1923–24	471	7	0
1924–25	431	6	0
1925–26	683	3	0
1926–27	864	6	0
1927–28	969	13	0
1928–29	601	14	0
1929–30	583	12	0
1930–31 }	Not known		
1931–32 }	,,		
1932–33	612	0	0
1933–34	461	8	0
1934–35	461	0	9

The high expenditure in 1921–22 was due to the formation of a number of interior scraped lines prescribed after the disastrous fire of 1920.

The Sholas of the Ampthill Downs Reserve and the Upper Palnis.

273. Mr. S. Cox gives a clear account of the history of the fire protection of the sholas of the Ampthill Downs Reserve in his "Inspection Notes on Madura Forests"—Proceedings of the Chief Conservator of Forests, No. 72, dated 17th September 1920. The following quotations are from his Inspection Notes :—

"The Ampthill Downs Reserve was constituted a reserved forest in 1906. When declaring it a reserved forest, Government ordered that the customary privileges of the people in respect of *burning grass* and free grazing should not be interfered with by the Forest Department.

"Since the object of applying the Forest Act to this country, which is uninhabited and unsuitable for cultivation or occupation, was to conserve the water-supply of the many streams which take their rise in it, the question arose, and aroused a good deal of controversy, whether the object of reservation could be attained so long as there was no restriction on either burning or grazing.

"The Ampthill Downs are very similar to the Nilgiri Kundahs : the altitude and vegetation and general appearance are alike although the former are on a smaller scale.

"The chief difference appears to be that there are no cattle pens and that the incidence of grazing is therefore unevenly distributed and is only heavy near the villages. In fact on the southern side of the Downs there appears to be little or no grazing, but the grass is high and fires sweeping across from the more cattle-frequented parts do a great deal of damage.

"A curious local feature is that the villagers of the nearest villages although in possession of large areas of unreserved land have never been called upon to pay grazing fees in the reserve. Why this privilege, so opposed to the policy and practice elsewhere, including the Nilgiri Kundahs, has been granted is nowhere explained in the records. No claims to free grazing were advanced at the Forest Settlement. It may be presumed that the area of grazing being very large and the number of cattle small at the time of settlement it was not thought necessary or desirable to impose any restrictions or fees."

274. In 1907, the Government directed that up to one dozen sholas might be placed under special fire protection and records be maintained with a view to ascertain the vulnerability of sholas to fires.

The first system of fire protection adopted was that of clearing lines three feet wide all round the sholas, about 25 to 50 feet or more outside the edge, and burning the grass away from the lines. In 1910, attempts were made to protect a few of the sholas by means of ditches 1′ × 1′ all round them, burning of grass being dispensed with. Fires crossed over the ditches, so that this system proved to be unsatisfactory.

275. "In 1914 the Government, on receipt of reports from the District Forest Officer, the Collector and the Board of Revenue who were unanimous in the opinion that it was useless to waste time in conducting experiments to demonstrate the obvious fact that grass fires were a cause of injury to the shola forests, accepted that view but directed, while all possible measures should be taken to protect the sholas, that there should be no interference with either the burning of the grass or with the free grazing of cattle."

276. "In 1915 a scheme was prepared by the District Forest Officer, with the approval of the Collector, for the careful and permanent protection of the remaining sholas. The Downs were divided into two blocks :—

"Block I, remote from the villages, grazed over to only a limited extent and containing the largest of the existing sholas, was to be completely fire protected by the department ; but free grazing was to be permitted on the condition that the protected sholas in Block II were not burnt and that the villagers themselves refrained from burning any portion of Block I.

"In Block II, the villagers were permitted to burn the whole area except the sholas protected by the department and were permitted the concession of free grazing provided that these sholas were not willfully burnt.

"These proposals were commended to Government by the Board of Revenue as a fair solution of the difficulties which had been personally investigated by the Forest Commissioner, but the Government while accepting the programme of protection removed all restrictions on the freedom of the villagers."

277. "In 1918, Mr. P. M. Lushington after a personal inspection re-opened the whole question.

"In his inspection note of September 7th he laid special stress on the following points :—the immense value of the forests of the Upper Palnis as a reservoir at the headwaters of many streams and rivers ; the great destruction of shola forest which had already taken place especially at the northern end of the plateau where terraces and channels still show the old settlements which were watered from sholas long since gone ; the dependence on the diminishing water-supply of the cultivation in the Poombarai, Kukal and other villages below the upper plateau : the very small number of cattle in these villages compared to the large area of unreserved lands and the still greater area of the Ampthill Downs : the recent introduction and increasing numbers of goats which were grazed in the reserve, and lastly, the impossibility of protection so long as the villagers were entirely uncontrolled.

278. "The Collector, Mr. G. F. Paddison, in forwarding the Conservator's notes to the Board of Revenue, remarked that he was in agreement with Mr. Lushington and that terrible damage was being done by fire to the catchment areas of the Upper Palnis.

279. "The Board of Revenue in dealing with this subject in their Resolution, dated 15th May 1919, stated that the danger of grass fires to the evergreen sholas and consequently to the spring sources which they protect had not been in the least exaggerated and that the Forest Department would be accepting a heavy responsibility if it deliberately incurred this risk for the sake of the customary rights of a small number of graziers. While recognizing the difficulties of effectively stopping such fires it considered that the Forest Department should be given every assistance to establish control and directed the Conservator to submit revised proposals in order that Government might be moved for a reconsideration of their previous order."

280. On this the Conservator, Mr. Latham, submitted a scheme in 1919 under which Mr. Scot's Blocks I and II were reverted to, but to insure the co-operation of the villagers it was proposed to collect a small grazing fee as a security which would be refunded at the end of the year if protection was satisfactory. The villagers were not to do any independent firing of grass but were to assist the Forest Department in burning. No goats were to be admitted into the Downs.

The Collector, Mr. H. T. Reilly, was in agreement with the main proposals but suggested the closure of the Downs to grazing as penalty for incendiarism in lieu of the deposit of grazing fees suggested by the Conservator as security for good behaviour.

281. But neither of these two schemes contained any basis for fixing the responsibility of the individual villages for future acts of omission or commission. In order to fix this responsibility, Mr. K. A. Chengappa, in 1922, divided the Downs into six grazing blocks, each village being responsible for its allotted block. The villagers were to give free labour to the department in carrying out a modified form of early burning and to assist in putting out fires and in return they were to be allowed free grazing, *a privilege they already possessed*, thatch grass and dead fuel from the sholas and an annual sum of Rs. 140 to be distributed among them as a reward at the end of the fire season. The system of fire protection suggested was to burn the grass outwards from cleared lines three feet to six feet wide situated 25 feet to 50 feet away from the edge of the sholas, care being taken to see that fire did not get into this or another protected shola. No other restriction was imposed on the spread of the grass fire. This scheme was sanctioned in Chief Conservator's Proceeding No. 18, Mis., dated 18th January 1923. In 1923 the method was reported to have worked satisfactorily, but apparently the work had been neglected.

282. In 1925 the villagers did not render any help on the plea that they were called upon to clear new fire lines. But next year they refused all co-operation even when not called upon to open new fire lines : the department had very little hold on the villagers as the only possible penalty was the withholding of the very small reward of Rs. 140.

Consequently from 1926–27 the lines round the sholas were recleared and the burning was done departmentally. The annual cost of the operation rose to Rs. 300 from Rs. 140, the reward previously given to the villagers.

283. Along with the clearing of the lines in 1925–26 seeds of *Acacia decurrens* were sown broadcast along their lengths : this was repeated in 1926–27. In 1927–28 the seeds were dibbled in shallow pits spaced 3′ × 3′ along a few lines near Marianshola and Vandaruvu. Some of the seeds germinated and throve. This success resulted in a scheme prepared by Mr. D. F. Stileman in 1928 for the fire protection of the sholas and the pine plantations.

284. The object of Mr. Stileman's scheme was to establish rapidly a belt of wattle round the plantations and the Upper Palni sholas and reserves, with a view to form permanent live belts round them which would be proof against fires spreading into them from outside. Nursery transplants of the wattles were to be used for planting out. The total length

of lines proposed to be treated was 166½ miles—40 miles round the pine plantations, 66 round the sholas in the Ampthill Downs Reserve, 25½ in the Gundar valley and 35 miles round other sholas. The work was to be completed in ten years. This scheme was put into operation only for the pine plantations, however, the sholas being protected by scraping lines four feet wide well outside their edges and burning the grass to a width of 100 feet round them. A sum of Rs. 1,258 was spent on this work in 1928–29 and Rs. 958 in 1929–30.

285. The Chief Conservator of Forests (Mr. R. D. Richmond) investigated the problem early in 1930 and after a thorough inspection of the locality concluded that, apart from general abandonment of the sholas to their fate, the only course remaining, in view of the declared policy of Government not to permit any interference with the privilege of free grazing and burning on the Ampthill Downs, and in view of the success (or otherwise) of the various schemes for fire protection of the sholas which had been tried from time to time, was to select the more important sholas, or groups of sholas, and to protect them intensively and to abandon those too far degraded to be worth restoring. The method proposed was to consist of scraped fire lines with outward firing early in the season, *Acacia dealbata* or *Acacia decurrens* being introduced between the fire traces and the sholas. The wattle would afford additional protection to the sholas which would gradually extend outwards as far as the wattle belts.

286. The total length of the periphery of the sholas to be fire protected was 104 miles, as detailed below :—

	M.	F.
Sholas in Ampthill Downs R.F. (26 groups)	41	3
Sholas in Gundar valley R.F. (16 groups)	21	5
Sholas in Gundar valley extension R.F. (8 groups)	10	1
Other minor sholas (Tigershola, Perumalmalai shola, Kilanavayal, Swamikanal I and II and Kukkal)	30	3
Total ..	103	4
	or 104 miles.	

287. It was proposed to scrape a line eight feet wide from the edge of each large shola or group of small ones, two feet of the inside of which would have a mound and trench in which seeds of *Acacia dealbata* and other evergreen species would be sown in order to provide a living firebelt for the sholas. The work would be spread over three years taking up about a third (35 miles) of the periphery each year. In the fourth, fifth and sixth years another scraped line eight feet wide would be similarly dealt with. This would be continued until at the end of the twefth year there would be four lines of evergreen species, sown on mounds and in trenches, which would thereafter reproduce themselves naturally on the scraped lines so that all grass might be kept down. In addition to sowings in trenches and on mounds, at every half a mile basket plants were to be put in four feet apart along one chain : along the second chain seedlings would be transplanted in pits four feet apart and along the third chain seedlings would be transplanted in crowbar holes at the same espacement. The estimated cost of these operations was Rs. 7,000 for 104 miles of one strip of eight feet width, or a total of Rs. 28,000 for four such strips, spread over a period of twelve years. It was also specified that where the strip ran along a contour the trenches should be dug on the uphill side while in the case of longitudinal slopes a series of transverse trenches and mounds eight feet long and eight feet apart would prevent erosion. The species prescribed for sowing were *Acacia dealbata*, *Rhododendron arboreum*, *Hypericum mysorense* and other shola species. A Part II scheme on the lines specified above was to be prepared and submitted to Government for sanction.

288. As a precursor of this detailed scheme to be submitted to Government Mr. J. A. Master, in 1930–31, widened to six feet all the scraped lines round the sholas decided upon for special protection, had new lines scraped where there were none before and burnt the grass outwards to a width of 100 feet. The pine plantations were protected similarly over a boundary of eight miles four furlongs.

The total cost of these operations, including six fire patrols for five months, was Rs. 1,950.

In October 1932 the subordinates sowed, free of cost, seeds of *Acacia dealbata* over seven miles of the Bodinayakkanur common boundary and over about 18 miles round the sholas, but the results have been inappreciable.

289. The sub-joined statement shows the expenditure incurred on fire protecting the sholas from 1921–22 to 1934–35 ; this does not include the expenditure on raising wattle belts :—

Year.	Expenditure on Sholas.		
	RS.	A.	P.
1921–22	540	13	0
1922–23	484	3	0
1923–24	417	7	0
1924–25	356	5	0
1925–26	416	0	0
1926–27	404	12	0
1927–28	422	14	0
1928–29	382	8	0
1929–30	449	1	0
1930–31	482	2	0
1931–32	370	4	0
1932–33	448	2	0
1933–34	700	4	0
1934–35	470	14	0

290. The Part II Scheme referred to in paragraph 287 above was sanctioned in G.O. Ms. No. 328, Development, dated 15th March 1933, but no work could be undertaken under this sanction as the necessary funds were withheld.

291. Further experience in growing wattle belts was gained in the meantime by Mr. J. H. Longrigg, the District Forest Officer. In the light of this experience and the instructions issued by the Chief Conservator after a tour on the Upper Palnis in 1933 a revised scheme was submitted by him in 1934.

Under this scheme it was proposed to rely entirely on direct sowings of treated wattle seeds in prepared contour seed beds. The beds on slopes would be 8 feet long along the contours, 2 feet wide and spaced 10 feet apart along the slopes, or about 8 feet apart horizontally. The soil in the beds would be worked free of grass roots and stones to a depth of 9 inches and supported on the lower edge by turf and any stones taken out of them. On level stretches the beds would be almost continuous, broken only by an interspace of 2 feet every 20 feet to prevent them from forming drainage channels. A second belt exactly similar to the one described already would be arranged parallel to the first on the shola side of it so as to secure a total breadth of 16 feet of treated belt. This scheme was estimated to cost only Rs. 8,800 for the complete double belt of 104 miles. The work was to be done at the rate of about 10 miles of double belt every year, for a period of ten years, at an average annual cost of Rs. 880. Where the ground was rocky the belt would link direct with the edge of the shola ; in the case of several sholas treated as one unit, cross belts of wattle would be put in so as to break up the included grass land into smaller units.

292. On this 1934 scheme the Chief Conservator ordered that two selected sholas should be treated and the result observed. One of them (Perunkanal was chosen) was to be provided with an *Acacia* belt exactly according to the scheme and the other (Sirunkanal) with a belt of the same type, but with connecting links between the beds, according to a suggestion of the writer. The necessary soil preparation and sowing of *Acacia* to give effect to this order was done in 1935.

293. Meanwhile, at his camps on the Upper Palnis in 1933, 1934 and 1935, the District Forest Officer started some work in each beat and camp to gain experience of these methods of direct sowing in level sections of prepared soil on grass land. Beat staff and fire patrols did much of it and some paid labour was engaged out of savings from the fire protection estimates. The lengths done (including the two sholas named above) were as follows :—

Shola.	Length of belt in chains.	Cost.		
		RS.	A.	P.
Anaigiri	22·58	10	0	0
Marianshola	103·20	110	15	6
Vandaravu cum Pallankadu }	41·22 48·36	137	15	0
Kukkal	35·00	26	7	0
Samikanal	9·00	52	5	0
Gundanpoochikanal	70·75	72	3	0
Nariyanagar	69·20	44	8	0

Shola.	Length of belt in chains.	Cost. RS. A. P.
Pannithulamkanal	55·00	..
Manavartankanal	47·40	..
Sirungan Saragam	39·10	32 8 0
Perunkan Saragam	207·91	171 0 0
Totals for 3 years' work ..	748·72	657 13 6

294. Meanwhile, the sholas and plantations of the Upper Palnis continue to be fire-protected mainly on the lines indicated below :—

The scraped lines round the sholas (100·5 miles) and the pine plantations (8·5 miles) are recleared to a width of 4 feet to 6 feet and lines about a hundred feet wide are burnt outward from them. This costs about Rs. 763 at Rs. 7 a mile. Six fire patrols are maintained from January to May (inclusive) at Rs. 14 a month, the total cost being Rs. 420. A lump sum of about Rs. 75 is provided for contingent expenditure on coolies for fire fighting and on hire of motor buses for their transport. The total cost, including Rs. 108 for fire tracing the roads referred to in paragraph 266, is about Rs. 1,350 for the whole range.

295. *Results.*—A scrutiny of fire maps and the statistics of fires for the last ten years reveals that the range has been subject to extensive annual fires. The grass areas of the Upper Palnis have naturally been the worst to suffer but the *Terminalia chebula* type (Perumalmalai, for example) has also been burnt though to a less extent. The Perumalmalai reserve was set fire to several times early in 1931, upon which the portion above the ghat road was closed to grazing for two years from May 1931 : it has not yet been opened. The ghat road is not being fire traced in this locality so that fires have continued in spite of the closure. In the reserves adjoining the plains fires have been frequent round enclosures and along paths leading up to hill villages (Periyur, Vellagavi, Adukam and Pulathur). The fire tracing of these paths where they pass through grass and of the remaining part of the motor ghat road to Kodaikanal not now fire traced should therefore afford further protection.

The fires in the grass areas of the Upper Palni plateau cannot be prevented until the privilege of burning the Ampthill Downs is withdrawn from the villagers and it is doubtful if it can be achieved then. The system of scraped lines now in force has been generally effective in protecting the " islands " of sholas dotted about the Upper Palni " sea of grass," but where the grass has remained unburnt for 2 or 3 years continuously the intensity of the succeeding fire has often singed the edges of the sholas in spite of the scraped lines. The advantage of confining the burn to a hundred feet from the scraped line is therefore doubtful.

It may be granted that grass fires on the Downs are injurious to the conservation of the water-supply, but since the policy of Government is such that they cannot be prevented the intensity of the fires can be mitigated by burning the grass *annually*. This will lessen the evil effects on the water-supply as well as the danger to the sholas which have been taken up for rigid protection. Since the local populace want the grass burnt their co-operation should be easy to secure and firing should take place under departmental control, starting, in each case, as far as possible, from the edges of the sholas the rigid protection of which has not been prescribed, so as to minimise damage to them. The more important sholas will therefore be protected intensively by scraped lines and *Acacia* belts and the degraded ones will be preserved as far as possible by starting burning operations from them and burning outwards, under departmental control. (Vide paragraph 821 of Part II.)

296. The sub-joined tabular statements exhibit for the past 10 years—

(1) The annual cost of fire protection operations in each range.

(2) The number and origin of fires.

(3) The number of annual fires with the minimum and maximum area burnt in one fire, for the reserves subject to fires.

Cost of fire protection for the past ten years in the Madura Forest Division.

Name of range.	Cost of fire protection.									
	1924–25. RS. A.	1925–26. RS. A.	1926–27. RS. A.	1927–28. RS. A.	1928–29. RS. A.	1929–30. RS. A.	1930–31. RS. A.	1931–32. RS. A.	1932–33. RS. A.	1933–34. RS. A.	1934–35. RS. A.
Kodaikanal.	922 2	1,145 9	936 10	1,886 5	1,315 5	2,362 14	1,949 5	1,914 3	1,628 14	1,452 12	1183 3
Palni ..	62 0	75 0	100 0	100 0	94 0	99 14	345 11	331 0	333 0	317 6	220 0
Cumbum ..	391 14	413 15	390 0	295 13	348 0	289 7	779 1	539 14	314 14	487 0	483 9
Sholavandan.	141 2	95 0	252 8	158 0	156 0	156 0	156 0	156 0	150 14	158 0	154 0
Aiyalur ..	30 0	70 0	59 9	70 0	70 0	70 0	80 0	80 0	80 0	116 2	..
Natham ..	490 0	397 12	233 14	244 0	195 0	244 0	246 0	246 0	246 0	280 4	146 0

Statement of number and origin of fires that occurred during 1924–34.

Year.	A. Fire caused by accident or carelessness in burning fire lines.		B. Fire entering the forest by crossing exterior fire lines.		C. Fire beginning inside the reserve or fire-traced lines. Owing to carelessness or accident. By workmen employed in the forest for purchase of forest produce and by hay cutters.		C. Owing to carelessness or accident. By villagers, travellers, etc., passing through the forest.		C. By intentional firing. In order to obtain new grass.		C. By intentional firing. Maliciously fired.		C. Total.		D. Causes unknown.		Total of A, B, C. and D.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
	No.	Acs.	No.	Acs.	No.	Acs.	No.	Acs.	No.	Acs.	No.	Acs.	No.	Acs.	No.	Acs.	No.	Acs.
1924	..	..	..	..	1	3	..	..	2	60	53	1,669	56	1,732	59	3,780	115	5,512
1925	2	9	9	185	1	50	..	..	..	..	52	2,348	64	2,592	96	6,212	160	8,804
1926	7	68	1	500	..	..	..	..	2	180	27	1,224	37	1,972	56	1,913	93	3,885
1927	..	..	3	98	2	105	..	..	..	..	22	748	24	853	102	4,606	129	5,557
1928	..	..	10	451	..	..	..	..	..	..	2	138	2	138	115	6,541	127	7,130
1929	..	..	21	2,275	..	..	..	..	..	..	..	..	..	..	77	2,468	98	4,743
1930	3	2,505	7	356	1	80	7	162	26	1,262	..	..	..	..	90	3,564	134	7,929
1931	2	10	10	1,158	2	439	9	1,059	9	1,310	1	15	21	2,823	85	2,555	118	6,546
1932	2	37	20	1,988	..	..	8	248	5	82	7	110	..	..	71	2,535	115	5,002
1933	5	422	35	6,650	3	122	6	179	4	647	9	3,353	22	4,301	114	7,991	176	19,366
1934	..	..	34	2,795	2	10	1	12	..	..	6	257	9	279	151	10,589	194	13,663

The number of annual fires in each range and the minimum and maximum area burnt in any one fire.

KODAIKANAL RANGE.

Name of reserve forest.	1925. Number of fires.	1925. Smallest fire acres.	1925. Largest fire acres.	1925. Total burnt acres.	1926. Number of fires.	1926. Smallest fire acres.	1926. Largest fire acres.	1926. Total burnt acres.	1927. Number of fires.	1927. Smallest fire acres.	1927. Largest fire acres.	1927. Total burnt acres.	1928. Number of fires.	1928. Smallest fire acres.	1928. Largest fire acres.	1928. Total burnt acres.	1929. Number of fires.	1929. Smallest fire acres.	1929. Largest fire acres.	1929. Total burnt acres.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
1 South slopes Reserve Forest.	17	5	94	600	11	3	50	214	15	2	50	233	27	3	133	301	11	2	20	89
2 Gundar Valley Extension.	3	40	210	290	3	2	250	257	1	..	..	200	..	..	..	..	1	..	..	200
3 Amburuvi	4	15	200	330	1	..	..	65	3	40	304	470	4	16	133	229	2	7	464	471
4 Perumalmalai	4	2	60	97	4	19	500	619	2	2	15	17	8	5	350	1,540	..	..	..	..
5 Tiger Shola	1	..	..	7	..	..	..	..	..	..	..	..	1	..	..	120	..	..	..	..
6 Adukkam	10	5	150	393	2	35	40	75	12	8	200	762	11	15	447	1,152	1	..	..	11
7 Ampthill Downs ..	2	500	800	1,300	1	..	..	16	..	..	..	..	1	..	..	10	..	..	..	..
8 Murugamalai	3	51	180	381	5	5	70	106	14	5	100	406	6	4	181	328	2	5	19	24
9 Pambar	2	28	45	73	4	..	315	345	3	39	150	259	..	..	..	..	..	..	..	..
10 Karungal Donimedu ..	1	..	..	25	1	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..
11 Agamalai	2	35	40	75	1	..	..	50	3	5	52	95	5	16	280	521	..	..	..	..
12 Keelanavayal	..	..	..	..	1	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..
13 Mankaradu	1	..	..	18	2	..	..	36	2	10	10	20	1	..	..	25	..	..	..	..
14 Shengalvarayar ..	..	..	..	..	6	1	360	521	..	..	..	..	2	38	40	78	1	..	..	1
15 Swamikanal	..	..	..	..	1	..	..	7	2	2	25	27	1	..	..	18	..	..	..	..
16 Kookal	..	..	..	..	..	..	..	..	1	..	..	200	..	..	..	..	..	..	..	..
17 Vanderevar and Narayan.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18 Gundan Shola	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19 Anagiri Shola	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20 Manjampatti	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
21 Gundar Valley ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
22 Glenfalls Shola ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Name of reserve forest.	1930. Number of fires.	1930. Smallest fire acres.	1930. Largest fire acres.	1930. Total burnt acres.	1931. Number of fires.	1931. Smallest fire acres.	1931. Largest fire acres.	1931. Total burnt acres.	1932. Number of fires.	1932. Smallest fire acres.	1932. Largest fire acres.	1932. Total burnt acres.	1933. Number of fires.	1933. Smallest fire acres.	1933. Largest fire acres.	1933. Total burnt acres.	1934. Number of fires.	1934. Smallest fire acres.	1934. Largest fire acres.	1934. Total burnt acres.
	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)
1 South Slopes Reserve Forest.	27	2	16	193	5	16	70	150	7	5	16	66	12	3	155	378	9	1	35	134
2 Gundar Valley Extension.	2	50	70	120	2	8	45	53	1	..	..	3	3	1	600	634	3	3	500	703
3 Amburuvi	4	28	83	215	1	..	..	160	5	2	200	302	1	..	..	51	3	56	176	402
4 Perumalmalai	2	25	280	305	7	15	370	1,245	9	2	80	258	8	15	250	515	6	9	30	109
5 Tiger Shola	1	..	..	10	2	19	150	169	4	2	15	28	5	5	15	47	4	4	15	36
6 Adukkam	6	5	150	341	4	9	72	123	7	3	60	226	3	4	80	102	3	22	43	89
7 Ampthill Downs ..	2	280	2,500	2,780	2	5	100	105	2	4	20	24	7	6	1,008	2,170	9	4	300	1,414
8 Murugamalai	6	5	90	187	1	..	..	31	5	9	55	123	8	6	45	145	2	3	12	15
9 Pambar	3	57	190	417	2	19	74	93	4	27	55	160	3	6	74	90	3	21	86	117
10 Karungal Donimedu ..	3	21	160	221	..	..	..	..	1	..	..	78	1	..	..	20	..	..	..	..
11 Agamalai	..	..	..	..	..	..	..	..	2	15	52	67	1	..	..	19	1	..	..	64
12 Keelanavayal	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13 Mankaradu	1	..	..	10	..	..	..	..	2	9	15	24	2	9	40	49	..	..	..	..
14 Shengalvarayar ..	3	1	106	131	..	..	..	..	1	..	..	126	..	..	..	..	..	..	..	..
15 Swamikanal	..	..	..	..	1	..	..	20	2	35	95	130	..	..	..	..	..	..	..	..
16 Kookal	1	..	..	300	..	..	..	..	1	..	..	50	3	3	25	341	1	..	..	400
17 Vanderevar and Narayan.	1	..	..	**90**	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18 Gundan Shola	1	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
19 Anagiri Shola	..	..	..	..	3	5	15	30	..	..	..	..	1	..	..	7	1	..	..	5
20 Manjampatti	..	..	..	..	1	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..
21 Gundar Valley ..	..	..	..	..	1	..	..	30	1	..	..	60	..	..	..	..	1	..	..	1,000
22 Glenfalls Shola ..	..	..	..	..	..	..	..	..	1	..	..	2	..	..	..	..	..	..	..	..

The number of annual fires in each range and the minimum and maximum area burnt in any one fire—**cont.**

PALNI RANGE.

Name of reserve forest. (1)	1925. Number of fires. (2)	1925. Smallest fire acres. (3)	1925. Largest fire acres. (4)	1925. Total burnt acres. (5)	1926. Number of fires. (6)	1926. Smallest fire acres. (7)	1926. Largest fire acres. (8)	1926. Total burnt acres. (9)	1927. Number of fires. (10)	1927. Smallest fire acres. (11)	1927. Largest fire acres. (12)	1927. Total burnt acres. (13)	1928. Number of fires. (14)	1928. Smallest fire acres. (15)	1928. Largest fire acres. (16)	1928. Total burnt acres. (17)	1929. Number of fires. (18)	1929. Smallest fire acres. (19)	1929. Largest fire acres. (20)	1929. Total burnt acres. (21)
1 P. V. Valley	10	4	160	425	4	3	30	73	..	..	..	..	..	..	..	..	1	..	..	45
2 Marudanadiar	4	51	150	403	1	..	..	55	..	..	..	..	5	16	37	115	1	..	..	15
3 Northern Slopes ..	4	8	56	127	1	..	..	6	10	1	124	404	3	4	38	58	1	..	..	11
4 Kallar	1	..	..	36	2	4	120	124	4	56	107	319	2	14	125	139	3	69	164	313
5 Kovilady	1	..	..	72	1	..	..	46	1	..	..	29	1	..	..	31	1	..	..	27
6 Arunkanal	1	..	..	152	2	75	75	150	2	22	57	79	2	6	82	88	2	34	63	97
7 Vennilai	5	3	100	281	..	..	..	..	7	10	85	263	5	16	110	213	1	..	..	3
8 Siruvathukadu ..	1	..	..	45	..	..	..	..	1	..	..	70	4	2	10	28	1	..	..	62
9 Kudirayar	2	30	180	210	1	..	..	4	..	..	..	..	1	..	..	5	3	13	25	53
10 Mulaiyar	..	..	..	..	1	..	..	60	1	..	..	22	..	..	..	..	1	..	..	87
11 Velancombai	..	..	..	..	1	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..
12 Kadavumalai	..	..	..	..	..	..	..	..	2	33	78	111	..	..	..	..	1	..	..	42
13 Kaniankadu	..	..	..	..	..	..	..	..	1	..	..	93	1	..	..	83	1	..	..	100
14 Unjalnachi	..	..	..	..	..	..	..	..	2	52	56	108	1	..	..	8	..	..	..	..
15 Kokkuparai	..	..	..	..	..	..	..	[illegible]	1	..	..	72	1	..	..	19	1	..	..	40
16 Oliyanoothu	..	..	..	..	..	..	..	..	1	..	..	20	..	..	..	..	1	..	..	24
17 Karadikuttu	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18 Pambukallar	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Name of reserve forest.	1930. Number of fires. (22)	1930. Smallest fire acres. (23)	1930. Largest fire acres. (24)	1930. Total burnt acres. (25)	1931. Number of fires. (26)	1931. Smallest fire acres. (27)	1931. Largest fire acres. (28)	1931. Total burnt acres. (29)	1932. Number of fires. (30)	1932. Smallest fire acres. (31)	1932. Largest fire acres. (32)	1932. Total burnt acres. (33)	1933. Number of fires. (34)	1933. Smallest fire acres. (35)	1933. Largest fire acres. (36)	1933. Total burnt acres. (37)	1934. Number of fires. (38)	1934. Smallest fire acres. (39)	1934. Largest fire acres. (40)	1934. Total burnt acres. (41)
1 P. V. Valley	..	..	..	..	5	10	80	230	..	..	..	..	3	5	25	50	4	20	40	120
2 Marudanadiar	..	..	..	..	3	10	40	70	..	..	..	..	3	30	50	115	5	20	41	146
3 Northern Slopes ..	2	11	25	36	5	10	50	110	3	2	50	57	6	1	60	178	9	4	50	194
4 Kallar	4	5	145	256	2	73	131	204	4	20	90	155	2	5	80	85	4	25	37	124
5 Kovilady	1	..	..	82	1	..	..	82	1	..	..	25	2	50	100	150	1	..	..	125
6 Arunkanal	3	23	90	147	2	65	120	185	1	..	..	120	3	1	300	341	5	2	210	274
7 Vennilai	4	3	76	114	2	50	55	105	..	..	..	..	..	..	..	..	1	..	..	55
8 Siruvathukadu ..	1	..	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9 Kudirayar	..	..	..	..	..	..	..	..	1	..	..	30	..	..	..	..	8	28	400	1,153
10 Mulaliyar	2	73	95	165	2	12	15	27	1	..	..	60	1	..	..	40	2	50	125	175
11 Velancombai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12 Kadavumalai	1	..	..	60	1	..	..	60	1	..	..	40	..	..	..	..	1	..	..	37
13 Kaniankadu	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	91
14 Unjalnachi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	3
15 Kokkuparai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
16 Oliyanoothu	..	..	..	..	2	20	35	55	..	..	..	..	1	..	..	25	5	10	20	77
17 Karadikuttu	1	..	..	59	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
18 Pambukallar	..	..	..	..	..	..	..	..	1	..	..	15	..	..	..	..	..	..	..	..

CUMBUM RANGE.

Name of reserve forest. (1)	1925. Number of fires. (2)	1925. Smallest fire acres. (3)	1925. Largest fire acres. (4)	1925. Total burnt acres. (5)	1926. Number of fires. (6)	1926. Smallest fire acres. (7)	1926. Largest fire acres. (8)	1926. Total burnt acres. (9)	1927. Number of fires (10)	1927. Smallest fire acres. (11)	1927. Largest fire acres. (12)	1927. Total burnt acres. (13)	1928. Number of fires. (14)	1928. Smallest fire acres. (15)	1928. Largest fire acres. (16)	1928. Total burnt acres. (17)	1929. Number of fires. (18)	1929. Smallest fire acres. (19)	1929. Largest fire acres. (20)	1929. Total burnt acres. (21)
1 Kombai	2	35	42	77	4	21	63	187	..	..	..	..	1	..	..	40	7	5	330	924
2 Machakkal	2	4	5	9	1	..	..	10	..	..	..	..	..	..	..	..	6	14	162	435
3 Vannathiparai ..	5	25	90	242	5	2	80	197	..	..	..	..	..	..	..	..	6	10	168	544
4 Surulipatti	1	..	..	25	2	50	130	180	..	..	..	..	2	5	6	11	2	3	50	53
5 Budakaradu	1	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
6 Suranganar	..	..	..	..	2	16	40	56	..	..	..	..	..	..	..	..	1	..	..	245
7 Melgudalur	..	..	..	..	..	..	..	..	..	..	..	..	2	60	110	170	1	..	..	139
8 Kuttinachiar	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9 Poovathukaradu ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10 Dhonikaradu	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Name of reserve forest.	1930. Number of fires. (22)	1930. Smallest fire acres. (23)	1930. Largest fire acres. (24)	1930. Total burnt acres. (25)	1931. Number of fires. (26)	1931. Smallest fire acres. (27)	1931. Largest fire acres. (28)	1931. Total burnt acres. (29)	1932. Number of fires. (30)	1932. Smallest fire acres. (31)	1932. Largest fire acres. (32)	1932. Total burnt acres. (33)	1933. Number of fires. (34)	1933. Smallest fire acres. (35)	1933. Largest fire acres. (36)	1933. Total burnt acres. (37)	1934. Number of fires. (38)	1934. Smallest fire acres. (39)	1934. Largest fire acres. (40)	1934. Total burnt acres. (41)
1 Kombai	4	27	63	149	1	..	..	110	4	127	190	637	17	7	581	2,340	17	2	147	1,318
2 Machakkal	2	4	70	74	6	25	156	552	3	27	259	386	12	29	238	1,3[illegible]5	5	42	200	502
3 Vannathiparai ..	5	12	80	232	2	105	235	340	3	37	390	549	14	2	1,472	4,410	14	12	300	1,809
4 Surulipatti	2	30	180	210	2	303	334	637	2	60	90	150	3	214	514	1,228	8	1	250	936
5 Budakaradu	..	..	..	..	1	..	..	15	..	..	..	..	1	..	..	580	2	45	52	97
6 Suranganar	4	30	40	145	1	..	..	170	..	..	..	..	5	21	869	1,317	8	12	120	367
7 Melgudalur	1	..	..	30	1	..	..	134	1	..	..	180	5	22	394	568	4	3	130	203
8 Kuttinachiar	..	..	..	..	1	..	..	30	..	..	..	..	..	..	..	..	4	20	60	138
9 Poovathukaradu ..	..	..	..	..	1	..	..	188	..	..	..	..	1	..	..	360	1	..	..	60
10 Dhonikaradu	..	..	..	..	..	..	..	..		..	..	..	2	5	80	85	..	..	..	..

The number of annual fires in each range and the minimum and maximum area burnt in any one fire—**cont**

SHOLAVANDAN RANGE.

Name of reserve forest.	1925.				1926.				1927.				1928.				1929.			
	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
1 Sirumalai	6	5	48	179	7	16	46	183	18	2	80	502	7	20	103	322	19	8	32	327
2 Katchaikatti	1	..	..	17	1	..	..	44	..	..	..	..	..	..	..	..	..	..	..	..
3 Waguthumalai ..	10	1	53	240	5	6	45	99	8	6	55	182	5	42	150	367	3	13	82	162
4 Nallathevanpatti ..	4	10	45	87	1	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..
5 Vikramangalam ..	1	..	..	9	..	..	..	..	..	..	..	..	1	..	..	5	..	..	..	..
6 Rajadani	1	..	..	2	1	..	..	5	2	1	5	6	1	..	..	20	1	..	..	10
7 Andipatti South ..	3	5	27	57	1	..	..	8	3	8	200	243	3	15	20	50	1	..	..	30
8 Sirumalai North-west slopes.	..	..	..	..	..	..	..	..	..	..	..	..	5	12	32	105	2	1	8	9
9 Andipatti North ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	7	15	42
10 Sembatti	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Name of reserve forest.	1930.				1931.				1932.				1933.				1934.			
	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.
	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)
1 Sirumalai	14	3	76	289	16	2	62	258	17	3	125	461	12	10	120	842	2	20	20	40
2 Katchaikatti	..	..	..	..	2	25	50	75	..	..	..	..	1	..	..	25	2	13	17	30
3 Waguthumalai ..	4	48	192	359	12	5	70	390	9	7	50	181	9	7	180	371	10	4	90	299
4 Nallathevanpatti ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5 Vikramangalam ..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	2	4	2	7	8	15
6 Rajadani	1	..	..	18	2	5	20	25	..	..	..	..	..	..	..	..	1	..	..	15
7 Andipatti South ..	4	3	60	81	2	20	25	45	5	9	50	124	4	30	80	174	5	35	170	415
8 Sirumalai North-west slopes.	1	..	..	15	2	8	20	28	..	..	..	..	2	25	30	55	4	5	15	40
9 Andipatti North ..	..	..	..	..	2	..	18	18	..	..	..	..	1	..	..	80	..	..	..	..
10 Sembatti	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	20	..	..	..	..

AYYALUR RANGE.

Name of reserve forest.	1925.				1926.				1927.				1928.				1929.			
	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
1 Karandamalai	8	1	196	517	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2 Mudimalai	6	1	35	165	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3 Thoppaswamimalai ..	2	1	5	6	1	..	..	5	1	..	..	5	..	..	..	..	..	..	..	..
4 Karumalai	..	..	..	..	1	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..
5 Semmalai reserve forest.	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	34	..	..	..	..
6 Semmalai II	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	31
7 Viramalai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
8 K.R. Series	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9 Amayapuram	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10 Poigamalai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
11 Mogavanur	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
12 Methalamalai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
13 Semmalai Block I ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
14 Pannamalai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Name of reserve forest.	1930.				1931.				1932.				1933.				1934.			
	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.
	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)
1 Karandamalai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2 Mudimalai	..	..	..	..	..	..	..	..	1	..	..	1	1	..	..	0·31	1	..	..	1
3 Thoppaswamimalai ..	..	..	..	..	1	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..
4 Karumalai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5 Semmalai reserve forest.	1	..	..	25	..	..	..	..	1	..	..	128	..	..	..	..	..	..	..	..
6 Semmalai II	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7 Viramalai	2	1	42	43	1	..	..	4	3	1	3	6	..	..	..	..	..	..	..	..
8 K.R. Series	1	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9 Amayapuram	1	..	..	0·40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
10 Poigamalai	1	..	..	2	1	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..
11 Mogavanur	..	..	..	..	1	..	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..
12 Methalamalai	..	..	..	..	1	..	..	0·45	1	..	..	1	..	..	..	..	..	..	..	..
13 Semmalai Block I ..	..	..	..	..	..	..	..	..	1	..	..	5	..	..	..	..	..	..	..	..
14 Pannamalai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	

NATHAM RANGE.

Name of reserved forest.	1925.				1926.				1927.				1928.				1929.			
	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
1 Alagar Hills	4	1	5	10	..	..	..	..	1	..	..	15	..	..	..	..	..	..	..	..
2 Perumalai	6	10	80	199	2	..	..	12	8	17	91	319	4	4	25	64	6	5	32	76
3 Sirumalai North-west slopes.	4	3	15	42	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4 Sirumalai	7	10	40	150	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5 Karandamalai	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	10	..	..	..	..
6 Chinnapattikaradu ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
7 Chembulimalai ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Name of reserved forest.	1930.				1931.				1932.				1933.				1934.			
	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires	Smallest fire acres.	Largest fire acres.	Total burnt acres.	Number of fires.	Smallest fire acres.	Largest fire acres.	Total burnt acres.
	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)
1 Alagar Hills	3	1	1	1	1	..	..	21	2	1	23	23	..	..	..	..	4	8	21	52
2 Perumalai	2	10	30	40	4	22	40	119	1	..	..	50	5	18	37	107	6	11	67	298
3 Sirumalai North-west slopes.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4 Sirumalai	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5 Karandamalai	2	11	30	41	2	3	4	7	..	..	..	..	1	..	..	2	1	..	..	3
6 Chinnapattikaradu ..	..	..	..	..	1	..	..	..	1	..	..	3	..	..	..	..	..	..	..	..
7 Chembulimalai ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1

SECTION 5.—SPECIAL WORKS OF IMPROVEMENT UNDERTAKEN.

297. *Artificial regeneration of fuel coupes.*—The necessity to regenerate, artificially, the fuel forests in the vicinity of Madura had been recognized so long ago as 1887, when it was decided " to place the Kadavur forests (Alagar hills) under the most rigid protection and undertake cultural operations in the shape of sowing seed on raised platforms." Nothing appears to have been actually done, however. Attempts were made between 1909 and 1916 to regenerate artificially fuel coupes in the Ayyalur range (Trichinopoly) but no results appear to have been achieved.

298. The first serious attempts at artificially regenerating fuel coupes appear to have been made by Mr. K. A. Chengappa in 1920. Blanks in fuel coupes and fuel slides were dibbled with seeds of *Cassia auriculata, Albizzia sp., Melia indica,* sandal, bamboo and other species, but the results were unsatisfactory. His attempts to stock Timber Coupe I of the Karandamalai series with teak, in 1922–23, met with some success, however. Nothing tangible appears to have been done after this for some years.

299. Experimental work in connection with the regeneration of fuel coupes was started again in 1929–30, on a suggestion by the Chief Conservator of Forests. Seeds of fuel species were sown in the north-east monsoon in burnt patches in five coupes in Natham range, broadcast in blanks of six coupes in Ayyalur range and on an acre of ploughed ground in coupes XXI and XXII of the Viramalai reserve of Ayyalur range. The results were unsatisfactory except in the last case where the germination was profuse and there were a large number of seedlings in the beginning of the succeeding hot weather. In January 1931 the *Albizzia* was a foot high and the *Acacia planifrons* up to 3 feet in height, though the survivals had dwindled in number.

In 1935, the survivals were reported to be 120 *Albizzia* and 150 *Acacia* seedlings.

In the 1930–31 coupes, burnt patches in indicator areas were dibbled with seeds of fuel species in June and September 1930. The survivals were enumerated in December 1930 and showed a fair percentage of *Albizzia amara, Albizzia lebbek* and tamarind.

300. The work done from 1931–32 onwards is exhibited in the subjoined statements —

Rab sowings in Madura division.

Series.	1931–32. Coupe number.	Rab work done.	Cost.	1932–33. Coupe number.	Rab work done.	Cost.	1933–34. Coupe number.	Rab work done.	Cost.	1934–35. Coupe number.	Rab work done.	Cost.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
		ACS.	RS. A. P.		ACS.	RS. A. P.		ACS.	RS. A. P.		ACS.	RS. A. P.
SHOLAVANDAN RANGE.												
Andipatti, West	..	..	..	XVIII	2	..	XIX	26	12 4 0	XX	25	6 4 0
Do. Central	..	..	..	XV	2	..	XVI	21	11 12 0	XVII	30	7 8 0
Do. South	..	..	..	XV	2	..	XVI	4	1 14 0	XVII	20	5 0 0
Rajadani, North	..	..	..	XV	2	..	..	..	..	XVII	30	7 8 0
Do. West	..	..	..	XV	2	..	XVI	33	13 7 0	XVII	20	5 0 0
Vikramangalam, East	..	..	..	XV	2	..	..	..	..	XVII	20	5 0 0
Do. West	..	..	..	XV	2	..	..	..	..	XVII	20	5 0 0
Sirumalai, South	XIV	2	1 4 0	XV	2	..	XVI	56	21 1 0	..	..	..
Waguthumalai	XII	2	1 4 0	XI	2	..	X	33	14 4 0	IX	30	7 8 0
Sathiar	XIII	2	1 4 0	XIV	2	..	XV	14	7 8 0	XVI	35	8 12 0
Sembatti	II	2	1 4 0	III	2	..	IV	22	11 4 0	..	..	..
Sirumalai, East	XIV	2	1 4 0	XV	2	..	XVI	15	9 8 0	XVII	40	10 0 0
Anjukulipatti	XXX	2	0 15 0	IX	2	..	X	22	11 15 0	XI	35	8 12 0
Endlaparai	XIV	2	0 15 0	XV	2	..	XVI	7	4 6 0	XVII	20	5 0 0
Konapatti	..	..	..	XXX	2	..	XIII	28	13 0 0	XIV	25	6 4 0
Ambathurai	XXI	2	0 15 0	XXII	2	..	XXIII	31	15 8 0	XXIV	30	7 8 0
Rajadani, West	..	..	..	..	..	..	XVII	12	6 0 0	..	..	..
Moruthu	..	..	..	..	..	..	XIII	6	3 12 0	XIV	20	5 0 0
NATHAM RANGE.												
Karandamalai, East	XIV	2	2 0 0	XVI	8	2 0 0	XVI	48½	12 2 0	XVII	13	3 4 0
Do. West	II	2	2 0 0	IV	70	17 8 0	IV	36	9 0 0	..	..	..
Uduppugudi	XVIII	2	2 0 0	XXI	8½	2 2 0	XXI	67½	16 14 0	..	..	..
Chembulimalai	XX	2	2 0 0	XXII	8	2 0 0	XXII	30¾	7 11 0	..	..	..
Kasampatti	XIV	2	2 0 0	XVI	2½	0 10 0	XVI	18	4 8 0	..	..	..
Mulaiyur	IV	2	2 0 0	II	9	2 4 0	II	83	20 12 0	XVII	12	3 0 0
Budagudi	XIV	2	2 0 0	XVI	20	5 0 0	XVI	31	7 12 0	I	30	7 8 0
Pottapatti	XV	2	2 0 0	XVII	12	3 0 0	XVII	40	10 0 0	XVII	20	5 0 0
Karumalai	XXVI	2	2 0 0	XXVIII	16	4 0 0	XXVIII	39	9 12 0	XVIII	20	5 0 0
Methugamalai, North	XIV	2	2 0 0	XVII	10	2 8 0	XVI	37	9 4 0	XXIX	25	6 4 0
Do. South	XV	2	2 0 0	XVII	15	3 12 0	XVII	37	9 4 0	XVII	10	2 8 0
Alagarkoil	XIII	2	2 0 0	XV	22	5 8 0	XV	23½	5 14 0	XVIII	30	7 8 0
Vemburuli	XIV	2	2 0 0	XVI	25	6 4 0	XVI	37	9 4 0	..	..	..
Kadavur	VII	2	2 0 0	XXI	25	6 4 0	XXI	39	9 12 0	XVII	21	5 4 0
Perumalai	XXVI	2	2 0 0	XI	28	7 0 0	XI	41	10 4 0	XXV	61	15 4 0
Arukkampatti	XXVI	2	2 0 0	X	25	6 4 0	X	38	9 8 0	XXVIII	28	7 0 0
Kodangikuttu, South	XIV	2	2 0 0	XVI	31½	7 14 0	XVI	9½	2 6 0	..	..	..
Kanavoipatti	XII	2	2 0 0	X	70	17 8 0	X	9	2 4 0	XVII	23	5 12 0
Thethampatti	IX	2	2 0 0	..	..	..	III	11	2 12 0	IX	72	18 0 0
Karandamalai, North	VI	2	2 0 0	..	..	..	..	..	..	..	..	..
Perumalai, East	XIV	2	2 0 0	..	..	..	..	..	..	VIII	50	12 8 0
Kodangikuttu, North	XVII	2	2 0 0	..	..	..	..	..	..	..	..	..
AYYALUR RANGE.											PITS.	
Mudimalai	III	1	..	IV	60	15 0 0	IV	40	10 0 0	V	1,957	22 0 0
Shoremalai	..	..	..	IV	55	13 12 0	IV	10	2 8 0	V	1,000	10 8 0
Pannamalai	XV	1	..	XVI	40	10 0 0	XVI	41½	10 6 0	..	..	..
A. Kombai	..	..	..	XVI	50	12 8 0	XVI	20	5 0 0	XVII	243	Nil
Mungilkaradu	XII	2	..	IV	30	7 8 0	IV	19	4 12 0	V	952	9 0 0
Thoppaswami, South	XIX	2	..	XVIII	20	5 0 0	XVIII	20	5 0 0	..	..	..
Kaluvadi	XIV	2	..	XVI	45	11 4 0	XVI	15	3 12 0	XVII	337	3 6 0
Panjanthangi	XIV	2	..	XVI	10	2 8 0	XVI	41	10 4 0	..	..	..
Pillayarnatham, North	VI	2	..	VIII	80	20 0 0	VIII	20	5 0 0	IX	1,200	12 12 0
Do. South	III	2	..	I	40	10 0 0	I	37	9 4 0	..	..	..
Semmalai (Poigamalai)	..	..	..	XVI	70	17 8 0	XVI	78	19 8 0	XVII	647	10 2 0
Viramalai	..	..	..	XXV	30	7 8 0	XXV	60	15 8 0	XXV	1,044	7 2 0
K.R. Series, Kumarikatti	..	..	..	XXXV	40	10 0 0	XXXV	40	10 0 0	..	..	..
Thoppaswami, Central	XV	2	..	..	..	..	..	..	..	..	..	..
Do. North	X	2	..	..	..	..	..	..	..	..	..	..
Methalamalai Reserve	..	½	..	..	..	..	..	..	..	..	..	..
Kumarikatti	XXXIV	2	..	..	..	..	..	..	..	..	..	..
CUMBUM RANGE.											ACS.	
Kombai	XXV	2	2 0 0	XXVI	2	..	XXVII	30	..	XXVIII	8	13 0 0
Pudupatti	XXVII	2	2 0 0	XXVI	2	..	XXV	50	..	XXIV	10	15 0 0
Machakkal	XXII	2	2 0 0	XXIII	2	..	XXIV	70	..	XXV	8	12 0 0
Suranganar	XV	2	2 0 0	XVI	2	..	XVII	36	..	I	10	15 0 0
Surulipatti	XXV	2	2 0 0	XXVI	2	..	XXVII	30	..	XXVIII	10	15 0 0
KODAIKANAL RANGE.											PITS.	
Agamalai	..	..	..	V	18	4 8 0	VI	16½	4 2 0	..	..	..
Iruttar	..	..	..	..	..	..	XI	28	7 0 0	..	..	..
Pambar	..	..	..	X	54	13 8 0	XI	55½	13 14 0	XII	264	2 0 0
Adukkam	..	..	..	X	52½	13 2 0	XI	44	11 0 0	XII	264	2 0 0
Iruttar	..	..	..	X	15	3 12 0	X	12	3 0 0	..	..	..
Sadayaperumal	..	..	..	X	10	2 0 0	X	8	2 0 0	XII	396	3 0 0
Do.	..	..	..	..	..	..	IX	15	3 12 0	..	..	..
Do.	..	..	..	..	..	..	XI	13	3 4 0	..	..	..
Mankaradu	..	..	..	VI	15	3 12 0	VI	10	2 8 0	VII	132	1 0 0
Amburuvi	..	..	..	II	46½	11 0 0	..	..	..	..	..	..
Murugamalai	..	..	..	X	26	6 8 0	..	..	..	XII	264	2 0 0
Pambar	..	..	..	..	..	..	..	..	..	XII	660	5 0 0

301. Sowings in irregular rab patches were done in most cases until 1935, lines being adopted in but a few instances.

It is difficult to assess the results of these operations individually, as reliable enumeration statistics have not been maintained; speaking generally the results have not been discouraging. The results in Kodaikanal and Cumbum ranges, however, were poorer than in the other ranges.

302. For 1935 the work has been organized and co-ordinated. Patches 2′ × 2′ have been prepared at an espacement of 3 feet along burnt rab lines roughly 9 feet broad and about a chain apart, the soil being worked up to a depth of 6 inches: the patches await dibbling.

303. *Sandal propagation and tending.*—Sandal appears to have been introduced into the reserves of the old Vyampatti range (Trichinopoly district) as long ago as 1918 and some of the seedlings raised then may be seen in the Panjanthangi and Sigamkaradu reserves.

The artificial introduction of sandal into the reserves of Madura district, however, appears to have been inaugurated by Mr. K. A. Chengappa in 1921–22. He dibbled sandal seeds in a number of places in the fuel forests of the Sholavandan, Natham and Ayyalur ranges during that year but has recorded that no germination could be noticed owing to bad seed.

304. The next attempt was in 1923–24 when seeds were dibbled in many of the reserves of Natham range (including the Karandamalais, Perumalai and the Alagar hills): the results are again recorded as unsuccessful.

305. The first successful effort recorded was in 1924–25, when about 25 measures of sandal seeds were received from North Coimbatore and sown in several localities in each of the six ranges of the division.

Though failures were reported from some localities, there were a good number of survivals in most places.

Dibbling appears to have been done in plots half to one acre in extent up to the year 1931 after which small propagation centres, about 10′ × 10′ in size, were attempted. These operations have been continued up to date. But the localities were not always selected with sufficient knowledge of the requirements of sandal propagation. Very often the centres were located inside the evergreen type of forest on the banks of perennial streams (e.g., Periaruvi in Alagar hills and along the bridle path from Velancombai to Vilpatti) under dense shade, so that growth and spread have been considerably retarded. Also, centres have been created inside fuel felling series, in which the spread of sandal is likely to prejudice the primary object of the maximum production of firewood.

306. An interesting experiment was made in 1930–31 on the northern slopes of the Karandamalais inside coupe III of the Karandamalai Timber Series. Five acres were cleared and burned and patches were made at an espacement of 12′ × 12′. Sandal seeds were dibbled at each patch in June 1930, together with ragi (*Eleusine corocana*) and a ring of dhal (*Cajanus indicus*). The whole area was subsequently cultivated with a field crop of ragi in September 1931, except for small patches round the sandal seedlings. An amount of Rs. 92–8–0 was spent. Three hundred and ninety-six seedlings were originally counted at 316 stakes (there were 1,500 stakes in all). In 1935 there were 65 seedlings of an average height of 12 feet and a maximum height of 25 feet. The survivals are healthy and vigorous.

307. The following statement exhibits the successful results of the work done from 1924 to 1934 in the creation of sandal propagation centres :—

Statement showing Result of Past Artificial Regeneration of Sandal.

Serial number and reserve.	Beat or locality.	Year of operation.	Result of operations. Number or area of plots.	Result of operations. Number of plants surviving in 1935.	Remarks.
I. *Cumbum Range*—					
1 Vannathiparai ..	Udupayar	1928–29 and 1929–30.	2 sq. chains ..	38 plants ..	Average height 17′, maximum height 22½′.*
2 Do. ..	Near rest-house compound.	1924–25 and 1928–29.	Do. ..	4 plants ..	Average height 5′, maximum height 15′.*
3 Do. ..	Rest-house compound.	....	....	2 trees ..	12′ high .. .. ..*
4 Kombai R.F. ..	Thanniparai	1928–29 and 1929–30.	2 sq. chains ..	47 trees ..	Average height 14′, maximum height 26′.*
5 Dhonikaradu ..	Junction with Kuthanachiar.	1928–29 ..	1 sq. chain ..	18 trees ..	Average height 12′, maximum height 20′.*
II. *Sholavandan Range*—					
1 Rajadani R.F. ..	Valayapatti block ..	1921–22 ..	1 acre ..	4 trees ..	Average height 18′, maximum height 25′.*
2 Sirumalai R.F. ..	Madagamalai ..	1926–27 ..	2 acres ..	25 trees ..	Average height 5′, maximum height 8′.*
Do. ..	Do. ..	1931–32 ..	2 plots, 12′ × 12′.	2 trees ..	1′ high .. ..*
3 Do. ..	Tadaganachi	1931–32 and 1932–33.	3 plots, 12′ × 12′.	6 plants ..	Below 1′, maximum height 1′.*

* Measured in 1935.

Statement showing Result of Past Artificial Regeneration of Sandal—cont.

Serial number and reserve.	Beat or locality.	Year of operation.	Result of operations. Number or area of plots.	Result of operations. Number of plants surviving in 1935.	Remarks.	
III. *Palni Range*—						
1 P. V. Valley	Balasamudram, West.	1931–32 and 1932–33.	7 beds, 10′ × 10′	8	Average height 1′, maximum height 3′.	*
2 Do.	Balasamudram, East.	1931–32	1 bed, 10′ × 10′	1	10′ high	*
3 N. Slopes R.F.	Virupakshi beat	1932–33	3 beds, 10′ × 10′.	6	Average height 1¼′, maximum height 1½′.	*
4 Vennilai R.F.	Dasaripatti beat	1931–32	2 beds, 10′ × 10′.	5	Average height 1′, maximum height 2′.	*
5 Siruvathkadu	Kottavali	1932–33	1 bed, 10′ × 10′.	1	1¼′ high	*
IV. *Kodaikanal Range*—						
1 Amburuvi R.F.	....	1931–33	....	3	Average height 4′, maximum height 5′.	†
2 Agamalai	....	Do.	....	22	Average height 3′, maximum height 4′.	†
3 Pambar	....	Do.	....	49	Average height 2½′, maximum height 3′.	†
V. *Ayyalur Range*—						
1 Sorupam	....	1930	½ acre	2	Average height 9′, maximum height 10½′.	*
2 Panjanthangi Valley.	....	1918 and 1921.	1 acre	9	Average height 8′, maximum height 13′.	*
3 Seegamkaradu	....	Not known.	½ acre	2	Average height 10′, maximum height 11′.	*
4 Semmalai B. II.	....	Do.	½ acre	19	Average height 6′, maximum height 17′.	*
5 Thoppasamimalai.	Mariyakonan Kaviar-saragam.	Do.	½ acre	2	6½′ and 7′	*
6 Semmalai B. I	Pariyankorai	12-6-1930.	½ acre	4	Height 5′ to 10′	*
7 Pillayarnatham.	South side	Not known.	½ acre	5	Height 19′ to 25′	*
8 Panjanthangi	....	22-10-1925.	½ acre	13	Height 4′ to 20.	*
VI. *Natham Range*—						
1 Alagar R.F.	Periaruvi	1924–26	....	7	Average height 11½′	*
2 Alagar hills	Aiyankodai	1932	....	7	Average height 1′ 1″	*
3 Do.	Do.	....	....	149	Average height 12′, maximum height 26′.	*
4 Karandamalai	Timber coupe in Aiyankodai Valley.	1930–31	5 acres	65	Average height 12′, maximum height 25′.	‡

* Measured in 1935. † Results recorded in 1934. ‡ Raised with field crops.

308. *Tending of sandal.*—Intensive tending of natural sandal appears to have been taken up only in 1928, before which the tending was apparently being done by the beat subordinates.

The subjoined table gives the localities tended each year and the amount spent for the purpose :—

Year.	Range.	Locality tended.	Area in acres.	Amount spent.
				RS.
1928–29	Cumbum	Vellaparai-Kombai (part)	70	23
1929–30	Do.	Do.	60	25
Do.	Kodaikanal	Southern slopes reserved forest (part)	Not known	25
1930–31	Cumbum	Fuel coupes XVI, XVII, Kombai series	25	25
Do.	Kodaikanal	Southern slopes reserved forest (part)	Not known	25
Do.	Palni	Unjalnachi R.F.	220	50
Do.	Sholavandan	Endalaparai series and along Sirumalai Bridlepath.	270	50
Do.	Natham	Perumalais	20	25
1931–32	Cumbum	Fuel coupes III and IV of Kombai series	70	25
Do.	Kodaikanal	Southern slopes reserved forest (part)	Not known	50
Do.	Palni	Marudanadiar reserved forest and Northern slopes reserved forest.	290	50
Do.	Sholavandan	Sathiar, Valayapatti, Vadakadu, etc.	320	50
Do.	Natham	Karandamalais	50	25

309. *The Vannathiparai experiments.*—In March 1926, the Chief Conservator inspected the Cumbum Valley and directed that experiments be started to study the regeneration of timber species in the Vannathiparai Valley.

An experimental scheme for the Vannathiparai forests was accordingly prepared by Mr. A. V. Sundaram under the direction of Mr. A. Wimbush, with the object of carrying out experiments to find out satisfactory methods of treating the best type of timber forests in the Vannathiparai Valley. The main questions raised were : (*a*) "Can the timber in these forests be harvested profitably in such a way that natural regeneration, chiefly from seed, can be relied upon to reproduce a crop which can suitably be worked on some High Forest System ? (*b*) As an alternative to the above, can the present crop be harvested profitably in such a way that a new crop composed partly of coppice shoots and partly of artificially introduced seedlings can be raised with certainty and worked as a pole forest on a comparatively short rotation ? (*c*) Failing the possibility of harvesting profitably *all* the existing mature trees which are not required as seed-bearers, can a new high forest be raised, chiefly by natural means, under such trees of the existing crop as it may not be profitable to sell ?"

It was considered that an answer to question (*a*) could be obtained by retaining certain seed-bearers over the experimental plot and felling the rest of the crop ; the felled material would then be sold and the resulting regeneration watched. If an area were clearfelled, and after the removal of all saleable material, the refuse were burnt and all blanks stocked artificially, an answer to question (*b*) would be available. And the last question would receive an answer if, after the retention of the seed-bearers, only such trees were felled as were readily saleable at a profit, the rest of the trees being girdled.

310. To provide the answers, therefore, six experimental plots were opened in April 1926, three to watch the regeneration of *Dalbergia latifolia* and the other three to watch that of *Adina cordifolia*. In all these plots all trees except *Dalbergia latifolia* and *Adina cordifolia* were girdled in June 1926 and the undergrowth was cut and burned. Only a few *Grewia* and *Eugenia* had died by March 1927 as a result of the girdling, and no effect was observed on *Schleichera trijuga*, *Polyalthea cerosoides*, *Wrightia tinctoria*, *Stereospermum chelonoides* and *Bridelia retusa*. It was consequently prescribed that in Plots I to III all trees, except the *Adina* and *Dalbergia* already chosen as seed-bearers, would be clearfelled; all saleable material would be removed by the end of the following January; Plots I and II would be burnt in the first half of January and Plot III in the first half of February. In Plots IV to VI, the seed-bearers of *Adina* and *Dalbergia* would be retained; of the girdled trees, all sound and saleable dead specimens above 4 feet in girth of *Stereospermum*, *Grewia*, *Schleichera*, *Eugenia* and *Albizzia* would be felled and removed by the end of January; the others being more deeply girdled or felled, whichever was found to be cheaper. Natural regeneration was expected to make its appearance in these experimental plots and was to be tended suitably. In Plots I and II it was to be supplemented by the artificial regeneration of teak, *Dalbergia latifolia*, *Albizzia odoratissima*, *Albizzia lebbek*, *Cedrela toona* and *Pterocarpus marsupium*.

311. A plot of 25 acres was also to be opened in which 5 acres were to be clearfelled each year, all trees under 6 feet in girth being *coppiced* flush with the ground and all saleable material removed from the coupe by the end of December. The slash was to be burnt in heaps between the coppiced stools in April, in such a way as to cause the minimum injury to the latter.

The resulting ash would be mixed up with the soil and the plot would be artificially regenerated by sowings as in the case of Plots I and II and by stump planting of teak, *Dalbergia latifolia* and *Albizzia lebbek*. The plots would be tended as required.

312. The history of these plots is summarized below :—

Plot I.—Opened in April 1926. Area 1·9 acres. Seed-bearers of *Adina* and *Dalbergia* were retained and the rest girdled in June 1926. Undergrowth was cleared and burned in June 1926. A few *Dalbergia* seedlings were noticed in July 1926 but no *Adina*. The area was burned again in February 1927 and weeded in May. Natural regeneration of *Dalbergia*, *Eugenia* and *Melia dubia* was observed. The plot was burned for the third time in January 1928. *Adina* seedlings were noticed in May 1928. The area was then dibbled at an espacement of 6′ × 6′ with seeds of teak, *Dalbergia*, *Pterocarpus* and *Albizzia* in May 1928. Casualties were replaced and the area was kept weeded as necessary till December 1929. A final enumeration of seedlings was made in January 1932: the statement in paragraph 314 below shows the number of survivals per acre.

A large number of *Melia dubia* poles up to 30 feet in height are now found scattered over the area. The teak and *Albizzia* are suppressed. The *Adina* and *Dalbergia* saplings are the most promising but require to be freed from miscellaneous species which infest the area. The saplings occur in patches and are up to 10 feet in height.

Plot II.—Opened in 1926. Area 0·73 acre. Seed-bearers of *Adina* and *Dalbergia* were retained and the rest girdled in June 1926, and the undergrowth was cleared and burned. The area was ploughed in June and seeds of *Adina cordifolia* were sown broadcast, with no results. It was burned again in January 1927. Natural seedlings of *Dalbergia*, *Eugenia* and *Melia dubia* were noticed, but no *Adina*. The area was burned for the third time in January 1928. A few seedlings of *Adina*, *Dalbergia* and *Albizzia odoratissima* were observed in March. Seeds of teak, *Dalbergia*, *Albizzia lebbek* and *Pterocarpus marsupium* were dibbled in May 1928, at an espacement of 6′ × 6′. Germination was good. Casualties were replaced and the area was kept weeded as necessary up to 1931. The results of enumeration made in January 1932 will be found in the statement in paragraph 314 below.

The present condition of this plot is similar to that of Plot I.

Plot III.—Opened in 1926. Area 1·05 acres. All *Adina* and *Dalbergia* were retained as seed-bearers and the rest were girdled in June 1926. Undergrowth was cleared and burnt in June and the area was ploughed. There were some *Dalbergia* seedlings to start with but no *Adina*. It was burned again in February and March 1927. A second ploughing was done in March. A large number of seedlings and root-suckers of *Dalbergia* were counted in May at the time of weeding. All girdled trees were felled and removed in February 1928 and the plot was burnt. The area was weeded in August 1928, October 1929 and December 1931. The result of enumeration of seedlings made in January 1932 appears in the statement in paragraph 314 below.

The seedlings are now generally smaller than in Plots I and II : other conditions are similar.

Plot IV.—Opened in 1926. Area 0·2 acre. Seed-bearers of *Adina* and *Dalbergia* were retained and the rest girdled in January 1926 when the undergrowth was cleared and burned and 600 pits were dug at an espacement of 6′×6′. Seeds of *Dalbergia latifolia* were dibbled in them in June 1926, but with no results. The plot was burned again in February and March 1927 and weeded and dibbled with *Dalbergia* seeds in May 1927. Four hundred and twenty-five seedlings were counted in August. The girdled trees were felled in October 1927 and the area was burned in February 1928, for the third time. The resulting seedlings were kept weeded as necessary till December 1931. Enumeration in 1932 gave results as exhibited in the statement in paragraph 314 below.

This plot is more or less in the same condition now as Plot III.

Plot V.—Opened in 1926. Area 1·5 acres. Seed-bearers of *Adina* and *Dalbergia* were retained, the remaining trees were girdled and the undergrowth cut and burned in June 1926. Natural seedlings of *Dalbergia* were observed at the start. The area was burned again in February 1927 and ploughed and fenced in March 1927. Only a few seedlings of *Dalbergia* were noticed in June when the plot was weeded. It was therefore burned again in February 1928. A large number of *Adina* and *Stephegyne* seedlings were noticed all over the plot in August. The plants were kept weeded as necessary till they were enumerated in January 1932 : the result is given in the statement in paragraph 314 below.

The present condition of this plot is similar to Plot IV except that it contains a larger number of *Stereospermum* saplings.

Plot VI.—Opened in 1926. Area 2·52 acres. All seed-bearers of *Adina* and *Dalbergia* were retained and the other trees girdled in June 1926. Undergrowth was cleared and burnt and the area ploughed in June 1926, when seedlings of *Dalbergia* were noticed. A few seedlings of *Dalbergia, Albizzia* and *Eugenia* were observed in June 1927 but no *Adina*. The girdled trees were felled in January 1928 and the area was burned in February. In July 1929 all inferior growth was cut down. A large number of natural seedlings of *Stereospermum, Dalbergia* and *Albizzia* were observed in July 1929. A fire passed over the plot in April 1931 but caused no appreciable damage. The area was kept weeded till enumerations were made in January 1932 : the results will be found in paragraph 314 below.

Stereospermum and *Dalbergia* predominate and are up to 20′ in height now.

313. The history of 5-acre experimental plots in the 25-acre block is given below : these experiments were intended to study the possibility of raising a mixed pole crop grown partly from dibbled seed and partly from coppice shoots, on clearfelled areas :—

Coupe I.—An area of 5 acres was clearfelled and coppiced by the end of December 1927. Slash was burnt in patches in April 1928 without damaging the coppice shoots ; these patches were staked at an espacement of 6′ × 6′ and at each stake seeds of one of the following species were dibbled in June :—Teak, *Pterocarpus marsupium, Albizzia lebbek* and *Dalbergia latifolia.*

The area was regularly weeded during the following year and root suckers of *Dalbergia latifolia* and seedlings of *Melia dubia* were observed, along with good coppice regeneration of all tree species. Casualties among seedlings were replaced till June 1930 and the area was kept weeded as necessary till December 1931. Elephants damaged the teak seedlings, first in July 1929 and they were cut back in the following December and January. In April-May 1931, seeds of *Melia dubia* were dibbled to replace casualties. Elephants damaged the teak frequently. The results of enumerations of survivals made in January 1932 will be found in paragraph 314 below.

The teak is being broken down constantly by elephants. Patches of *Dalbergia* are remarkably well grown and are up to 20′ in height. *Melia dubia* has grown fast and prevails over the whole plot. A mass of coppice shoots of miscellaneous species interfere with the teak and are suppressing the *Pterocarpus* and the *Albizzia*, on account of which the latter species has suffered considerably.

Coupe II.—An area of 5 acres was clearfelled and coppiced by 30th November 1928. Charcoal burning was allowed in the area by mistake. Slash was burnt in heaps in April 1929, without damage to the coppice shoots. Ash and soil were raked up together and the area was staked and divided into six plots. In each of five plots *Albizzia lebbek, Dalbergia latifolia*, teak, *Albizzia odoratissima* and *Pterocarpus marsupium* were raised while in the sixth plot situated in a hollow all these species were mixed. Seeds of all species were dibbled at stakes at the end of April, and germination was noticed in May. The plots were then kept weeded as necessary and all casualties were replaced by seedlings of the respective species. In September 1930, stumps were used to replace casualties of teak and *Dalbergia*, and in July 1931, *Melia dubia* seeds were dibbled in order to replace casualties. Elephants damaged the teak several times, beginning from January 1930 : the damaged saplings were cut back.

The result of enumerations made in January 1932 will be found in paragraph 314 below. The present condition of this coupe is similar to that of coupe I.

Coupe III.—This plot of 5 acres was felled by January 1930 and burned in heaps away from coppice shoots in the third week of the following April. The resulting ash was mixed up with the soil and the area was staked at an espacement of 6′ × 6′. It was then divided into eight sub plots which were respectively regenerated with the following :—

Pterocarpus marsupium seeds, *Dalbergia latifolia* stumps in pits' teak stumps, *Albizzia lebbek* seeds, *Dalbergia latifolia* stumps in crowbar holes, teak seeds, *Albizzia lebbek* seeds and *Pterocarpus marsupium* seeds.

The seeds were dibbled in April 1930 and the stumps were planted in August. The plot was kept weeded and casualties were replaced as necessary, till December 1931. Elephants damaged the teak several times beginning from November 1931. The survivals were enumerated in January 1932 and the results are exhibited in the statement in paragraph 314 below.

The present condition of the coupe is similar to that of coupes I and II.

314. Since the scheme was prescribed for a period of five years only, further work was stopped early in 1932. The subjoined statement exhibits at a glance the financial and silvicultural results of the experiments :—

Results of Vannathiparai experiments.

Description of plot.	Area in acres.	Year of initiation.	Revenue derived per acre.	Cost of regeneration pet acre up to 31st March 1932.	Survivals per acre in January 1932.		
					Natural seedlings.	Coppice shoots.	Artificial seedlings.
			RS. A. P.	RS. A. P.			
Plot I	1·90	1926–27 ..	94 0 0	85 10 0	463	6	868
,, II	0·73	Do. ..	94 0 0	137 8 0	278	21	930
,, III	1·05	Do. ..	109 0 0	101 0 0	1,080	7	..
,, IV	0·20	Do. ..	94 0 0	200 10 0	1,965	20	..
,, V	1·50	Do. ..	94 0 0	71 14 0	976	15	..
,, VI	2·52	Do. ..	94 0 0	45 10 0	308	18	..
Average ..	..	..	96 8 0	107 0 0	845	15	899
Coupe I	5	1927–28 ..	126 0 0	83 1 0	330	..	840
,, II	5	1928–29 ..	246 0 0	56 14 0	206	20	866
,, III	5	1929–30 ..	240 0 0	54 0 0	285	19	607
Average ..	..	..	204 0 0	64 10 0	274	13	771

315. The following conclusions may be drawn from the experiments :—

(1) The revenue derived from partial fellings was less than half of that from clearfellings, while the cost of artificial or natural regeneration of partially felled areas was usually much higher than that of clearfelled areas. Clearfelling followed by artificial or artificial-cum-natural regeneration is positively indicated as a sounder financial proposition.

(2) Natural regeneration under mother trees of *Adina* and *Dalbergia* can be secured in sufficient quantity, without the necessity for supplementing it artificially—but the cost of tending it till it is established is prohibitive, whether supplemented artificially or not. A good percentage of the regeneration of *Dalbergia* is by root suckers.

(3) Artificial introduction of teak, *Albizzia lebbek* and *Albizzia odoratissima* in natural regeneration plots is a difficult, costly and unsatisfactory operation, owing to constant danger from suppression.

(4) The resulting regeneration, artificial or natural, grows better and faster in the clearfelled areas than in the partly felled ones. This fact supports conclusion No. (1).

(5) In the Vannathiparai Valley, unless teak regeneration is effectively protected against elephants, no successful results can be achieved.

(6) *Melia dubia* comes up like a weed in clearfelled or partly felled areas after a burn and grows with remarkable rapidity.

316. The Vannathiparai Valley has now been set apart for the cultivation of lac on *Schleichera trijuga*). The question of regenerating it with species other than *Schleichera* may therefore be shelved for the present.

317. *The Surulipatti experiments.*—Early in 1930 a scheme to work the Surulipatti timber area was prepared by Mr. A. A. Khan, the main prescriptions of which were the extraction, by selection, of saleable timber trees over 6 feet in girth at breast height, and the improvement of the area by supplementing the natural regeneration of good species in gaps created by fellings, by artificial means and by tending. This scheme was held in abeyance pending the preparation of a regular working plan but it was ordered that experiments be conducted in the meanwhile to find out what results might be expected in respect of regeneration by following the prescriptions laid down in Mr. Khan's scheme. Improvement fellings, over as large an area as possible, were to be carried out among the *Shora talura* with a view to favour that species (for the sake of lac production); an experiment in the artificial regeneration of *Shorea* was to be conducted where its natural regeneration was sparse; sandal propagation centres were to be established on the banks of perennial streams; the financial aspects of manufacturing charcoal from *Anogeissus* were to be investigated; and above all things the forest was to be given rest and protection in the meantime.

318. In accordance with these orders, experimental plots were opened in 1930–31 to study the results of regeneration methods: a brief history of these plots is given below :—

Plot I.—The first plot of 5 acres was at Vekkalimaratholuvu. All trees of teak, *Pterocarpus marsupium* and *Adina cordifolia* over 6′ in girth were sold in 1930–31—five trees in all—for Rs. 24. All trees of 6′ girth and below, of the species named above, were numbered and found to be 171. The remaining species over one acre of the plot were felled, converted into charcoal and sold. All *bothai* grass was cut flush with the ground and blanks over the whole area were staked (1,800 stakes) and dibbled with seeds of teak, *Pterocarpus marsupium* and *Albizzia lebbek* in May 1931. The natural seedlings on the area were enumerated in June. Casualties were replaced with stumps of teak, *Dalbergia* and *Pterocarpus* in 1932 and 1933 and the area was kept weeded as necessary till 1934. The survivals were enumerated in July 1935.

Plot II.—The second plot of 5 acres was opened at Sinnapuliyampodai. All trees of teak, *Albizzia lebbek*, *Pterocarpus marsupium* and *Adina cordifolia* over 6′ in girth were sold standing; there were 12 in all. All trees of the same species 6″ in girth and under, of which there were 124, were marked for retention. All *bothai* grass was cut flush with the ground, and blanks were staked (1,200 stakes) and dibbled with seeds of teak in April 1931 as in Plot I. Natural seedlings were counted in June 1931 by stump planting of teak, *Dalbergia* and *Pterocarpus* and by sowing germinating teak seeds in August 1933. The plot was kept weeded as necessary and the survivals were enumerated in July 1935.

Plot III.—The third plot was at Periapuliampodai. All trees of teak, *Albizzia lebbek*, *Pterocarpus marsupium*, *Dalbergia latifolia* and *Adina cordifolia* over 6′ in girth were sold standing (16 trees in all) along with other trees, excluding 176 trees of the above species 6′ in girth and under, which were reserved. The contractor was permitted to make charcoal from the felled trees. In May 1931, seeds of teak, *Pterocarpus*, *Albizzia* and *Dalbergia* were dibbled in patches after soil working. All natural seedlings were counted in June. *Bothai* grass was cut in June 1931 and seeds of the abovementioned species were dibbled at 3,000 stakes. Germination was poor for want of rain. Casualties were replaced by stumps in October. Casualties were replaced again by dibbling germinating seeds of teak in August 1933. The area was kept weeded as required and the survivals were enumerated in July 1935.

Plot IV.—The fourth plot of 5 acres was opened at Thalaodai in the same year, 1930–31. There were 12 trees of *Dalbergia latifolia*, *Pterocarpus marsupium*, *Albizzia lebbek*, *Adina cordifolia* and *Shorea talura* over 6′ in girth on the area. One hundred and thirty-nine trees of the abovenamed species 6′ in girth and under were reserved, and the 12 trees were sold. All *bothai* grass was cut flush with the ground. Soil was loosened in patches and dibbled with seeds of tree species at 1,800 stakes in April 1931 and at another 1,800 stakes in June. The existing natural regeneration was counted in June. Casualties were replaced in August by means of stumps and again in October 1933. The area was kept weeded as necessary and the survivals were enumerated in July 1935.

Plot V.—The last plot was at Maharajanmettu. Trees of teak, *Dalbergia latifolia*, etc., above 6′ in girth were sold as in the other plots, reserving 122 trees of 6′ in girth and under. Seeds of teak, *Dalbergia*, *Pterocarpus* and *Albizzia* were dibbled at 600 stakes in May 1931, after cutting all *bothai* grass. All natural seedlings were enumerated in June 1931. The area received the same subsequent treatment as the other **plots. Survivals were enumerated in July 1935**

319. The subjoined statement exhibits the results of the operations in the five plots :—

Results of Surulipatty experiments.

Plot.	Area.	Revenue realized.	Cost of regeneration.	Other charges.	Number of natural seedlings. Teak.	*Dalbergia.*	*Pterocarpus.*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ACS.	RS.	RS. A. P.	RS. A. P.			
I	5	84	79 14 5	75 0 0	75	10	1,010
II	5	75	64 10 5	* 11 9 0	20	225	1,800
III	5	60	88 14 5	* 11 6 0	80	75	50
IV	5	88	80 2 5	* 11 9 0	40	700	120
V	5	50	72 14 5	* 11 9 0	10	1,420	250

Plot.	Number of natural seedlings—*cont.* *Albizzia.*	All species.	Survivals of natural and artificial seedlings in July 1935. Teak.	*Dalbergia.*	*Pterocarpus.*	*Albizzia.*	All species.	Remarks.
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
I	150	1,245	169	47	50	49	315	Charcoal burning.
II	700	2,745	325	279	210	115	929	
III	50	260	340	150	97	..	587	
IV	750	3,220†	175	106	59	..	340	
V	200	1,880	139	156	67	..	362	

* Demarcation charges. † There were 1,550 *Shorea*.

320. The following conclusions may be deduced from the experiments :—

(1) It is possible to supplement the natural regeneration of teak, *Dalbergia latifolia* and *Pterocarpus marsupium* occurring in gaps created by selection fellings on the Surulipatti plateau by artificial means by dibbling and stump planting, but the cost of such an operation ranges from Rs. 13 to Rs. 18 per acre. This includes regeneration and tending.

(2) The stocking obtained (60 to 186 seedlings per acre) is not commensurate with the expense incurred, nor is it sufficient.

(3) Though some plants have grown higher than the surrounding *bothai* grass, many require further tending before they can be declared to be in no danger from the grass. This will further increase the cost of regeneration.

(4) The advantages of *rab* sowings in *burnt* patches in reducing the invasion of weeds and *bothai* grass were not tested out properly, if at all.

321. *Shorea plots.*—Two plots were laid out in a *Shorea* area, each of one acre, and were protected from fire by scraped lines. In one of the plots all grass was cut and uprooted. One hundred seedlings of *Shorea talura* were staked out and numbered in each plot, and their heights measured. The rates of height growth in the two plots were to be compared, over a series of years. Measurements were first recorded on 1st August 1931 and for a second time on 25th May 1932. These measurements revealed that the average height growth was twice as rapid in the area from which the grass was uprooted (0·8″), as in the control plot (0·41″). No further work appears to have been done.

Other experiments in Cumbum.

322. *Albizzia lebbek.*—Over a plot of 2 acres, in the Vannathiparai valley, undergrowth was cleared and seeds of *Albizzia lebbek* were dibbled in patches on 23rd April 1927. Germination was noticed on 2nd May 1927. One thousand two hundred and twenty-six seedlings were counted on 23rd August 1927 which dwindled down to 755 on 2nd December 1927. In February 1928, the plot was burnt. A weeding was carried out in November 1929. There were 569 seedlings in March 1930, some of them from fresh seeds from adjoining mother trees. In December 1930, weeding was carried out over half the area only. An enumeration in January 1931 showed 550 seedlings in the weeded plot and only 150 in the unweeded one. Total expenditure incurred was Rs. 23–8–0. A large number of seedlings continue to live, but are not putting on any height for want of light.

323. *Albizzia odoratissima.*—Seeds of *Albizzia odoratissima* were sown broadcast on 24th April 1927 over 15 acres in the Vannathiparai forests, without clearing the undergrowth and without any soil preparation. Germination was observed on 2nd May 1927.

No enumerations appear to have been carried out till 1930. The area was weeded in March 1930 when 1,507 seedlings were counted. In December 1930, half the area was weeded. In February 1931, there were 583 seedlings in the weeded half and 598 in the unweeded half, below a height of 2 feet and 258 and 643, respectively, above that height.

Half the area was overrun by a fire in 1931. In January 1932, there were 600 seedlings in each half of the plot, under 2 feet high and 250 seedlings above that height in the weeded half, but 640 in the unweeded half. Natural seedlings of *Dalbergia latifolia, Adina cordifolia, Schleichera trijuga* and other species were also observed. A total expenditure of Rs. 53 was incurred.

An inspection in 1935 showed a good number of seedlings but they were all in a suppressed condition.

324. *Ceylon Satinwood.*—Two hundred seedlings of Ceylon Satinwood (*Chloroxylon swietenia*) were put out in 1928–29 in a grassy area in the Vannathiparai valley, to the left of the bridlepath going up to Medagaran mettu. A fire passed over a part of the area in 1930, but a number of seedlings survived the burn. In February 1931, there were 58 seedlings in the burnt area and 41 in the unburnt part. The subordinates kept the seedlings free of grass and weeds. In January 1932, there were 94 seedlings, some of them 3 feet high. The seedlings do not appear to have put on much growth after 1932 as they were found to be in much the same condition in 1935 (June). The expenditure incurred was Rs. 26.

325. *Artocarpus hirsuta.*—In April 1927, seeds of *Artocarpus hirsuta* were dibbled over one acre of semi-evergreen forest at an elevation of about 2,900 feet, along the Kumli ghat road, after clearing the undergrowth. There were 413 seedlings in November 1927, but only 312 in September 1929, of an average height of 8 inches. There were 218 seedlings in January 1930 but only 110 in December 1931, the largest one being 15 inches in height.

326. *Eriodendron anfractuosum.*—An open area of about 40 cents in extent was selected near Sethuvaikal in the Vannathiparai valley and 114 seedlings of *Eriodendron anfractuosum* (obtained locally) were planted out in pits 1′ × 1′ × 1′ on 25th November 1931 at an espacement of 6′ × 6′. The balance of the area was dibbled with seeds of the same species on 3rd December 1931, in patches of loosened soil, at the same espacement. The seeds germinated in ten days. Casualties were sought to be replaced in May 1932 by sowing seeds of *Bombax malabaricum* but this does not appear to have been attended with much success. The *Eriodendron* is about 20′ to 25′ in height now (1935) and has commenced to bear fruit.

327. *Eradication of prickly-pear.*—When Mr. C. C. Wilson was preparing the fuel working plan sanctioned in 1916, extensive areas in the fuel working circle had become so infested with prickly-pear (*Opuntia dillenii*) that he conducted certain experiments (in 1915) with a view to find out if it could be eradicated at a reasonable cost by sowing the seeds of species expected to produce sufficient shade ultimately to kill off the pear. Details will be found in Appendix VI of his plan. There are a large number of tamarind saplings in the Tannirkaradu experimental plot now, varying from one foot in height to a maximum of 15 feet, but they have not yet formed any canopy.

328. The eradication of prickly-pear by uprooting was prescribed in Mr. Wilson's plan in specified areas over which the density of the pear was below 30 per cent. The work was carried out for two years but the cost proved so prohibitive that it was abandoned under the sanction of the Chief Conservator. Subsequently, in 1930–31, the cochineal insect was introduced unto the division and systematic infection of all pear areas was carried out by the subordinates. This proved to be extremely effective: the pear was reported to be disappearing rapidly by the end of 1932. There is very little of it left now anywhere in the division.

329. *Kolakkattai grass* (*Pennisetum cenchroides*).—With a view to test if a good kind of fodder grass can be successfully grown in the lower grazing areas of the districts, two experimental plots of one acre each were opened in 1932 in coupe XVI of Kadavur series in the Alagar Hills reserved forest, just behind the rest-house at Vemburli. The soil was dug up to a depth of 6″—9″ and all existing grass was removed. Twenty pounds of the seeds of Kolakkattai grass were then sown on 20th August 1932. Germination was observed four days later. Owing to a break in the rains the crop became patchy. The grass flowered in December 1932, when it was about a foot high.

A second plot of one acre was sown in October 1932 after the soil had been prepared in the same manner as before. Germination was good. The stocking was fair in December 1932.

The total cost incurred on the two plots was Rs. 8.

The plots were inspected by the writer. The grass appears to thrive better under light shade than in the open, but on the whole the results attained have been poor.

It does not appear to be sound policy to raise foddergrass in the fuel forests of the Madura division, as they have to be managed primarily for maximum fuel production.

330. *Kikiyu Grass* (*Pennisetum clandestinum*).—Early in 1932 a suggestion was received from the Conservator of Forests, Working Plans Circle, to try the introduction of "Kikiyu grass" in suitable localities in the division. This grass is a native of South Africa and has the reputation of being one of the best fodder grasses.

Accordingly two experimental plots of half an acre each were opened in June 1932 in the Perumalmalai reserve forest, adjacent to the Kodaikanal ghat road, at an elevation of about 5,000 feet. All undergrowth was cleared, the existing grass uprooted and the resulting material was burnt.

Grass cuttings obtained from Mr. Clayton (Kodaikanal) were planted at 3′ × 3′ in one of the plots at the end of June 1932. The other plot was planted similarly in the middle of July with cuttings obtained from the Agricultural Department, Coimbatore. The total cost incurred was Rs. 26–6–0.

The grass has certainly taken root and is spreading slowly over the plots, but is subject to severe competition from the local grass and weeds which have invaded the area again.

331. *Plantations in rest-house compounds.*—The pine plantations attached to the following forest rest-houses on the Upper Palnis were raised in the years shown against each :—

(1) Poombarai—Area about 3 acres. Planted in 1910.
(2) Vandaruvu—Area about 10 acres. Planted in 1910–13.
(3) Marianshola—Area about one acre. Planted in 1913.
(4) Kukkal and Kavunji—The planted areas are small and the year of planting cannot be traced.

332. The teak round the Kanavaipatti rest-house was put in between 1920 and 1922.

333. Bamboos were raised round the Ayyalur rest-house in 1921.

334. *Climber cutting in fuel coupes.*—In 1919 it was prescribed (C.C.P. No. 48, dated 18th October 1919) that, as an experimental measure, the coupes in three fuel series should be demarcated three years ahead of felling and that climbers should be cut in them two years prior to felling as well as in the year after felling. The work was started in the Panjanthangi, Methugamalai South and Sirumalai South series in 1920, but was subsequently lost sight of. The operations were repeated in six coupes in 1928–29, when it was found that the climbers regained their former vigour within three months of the cutting back. It was observed in one case that 96 new shoots were thrown out from 32 shoots which were cut : upon this the matter was referred to the Working Plans Conservator for opinion and under his direction experimental plots have been opened (with controls) in coupe IX Sirumalai South, coupe XI Pannamalai and coupe VI Methugamalai South, with a view to arrive at conclusive results as to the smothering effect of climbers on the volume production of wood over a definite period of years.

335. *Coppice shoots of Albizzia amara.*—It is well known that *Albizzia amara* throws out a very large number of coppice shoots in the first instance, which later on thin themselves out to a reasonable number. There is therefore an apparent waste of energy in this initial production of a very large number of shoots. Mr. Wilson initiated an experiment in 1916–17 with the object of ascertaining if this prolific initial growth could be reduced by leaving the stumps rough and the bark ragged, instead of trimming the stumps and making a clean cut through the bark. In one experimental plot (Pillayarnatham) the trees were cut some 5″—8″ above the ground and in the two others (Karandamalai and Rajadani) they were cut flush with the ground.

These experimental plots were inspected by the writer. No definite conclusions can be drawn at this stage as the number and size of the coppice shoots in the plots were on the average the same in the areas treated differently. No records could be traced noting the initial number of shoots produced after coppicing.

336. Mr. Wilson also wished to ascertain whether, by judicious thinnings among the coppice shoots, a more vigorous growth could be encouraged in those that are left behind. With this object plots were laid out in the Alagar Hills, Mudimalai and Andipatti North reserves, and the coppice shoots were thinned judiciously in 1915–16, leaving 2—5 vigorous shoots on each stool. No control plots were laid out, as it was considered that areas adjacent to the sample plots were sufficient controls.

The plots in the Alagar Hills and Andipatty reserves were vitiated by illicit fellings. The one in the Mudimalai reserve forest was felled in 1933 by the writer and the resulting material was stacked and measured. An equal area adjoining the plot was also felled and measured at the same time. The experimental plot yielded 112 cubic feet of *Albizzia amara* and 118 cubic feet of other species while the control plot gave 76 c.ft. of *Albizzia amara* and 158 c.ft. of other species. No definite conclusions can be drawn from this solitary example.

337. In addition to observations in these experimental plots, it was prescribed in his plan that coppice shoots of *Albizzia amara* should be heavily thinned in all coupes of the Sholavandan range in the first and sixth year after felling, in the Ayyalur range in the third year and in the Natham range in the fifth year. This was carried out in 1918–19. Mr. Latham, however, thought in 1919 that the thinnings had not given very obvious results, that they cost a large sum in the aggregate and that though it was possible they would give better poles, it was not certain that a larger outturn of fuel would result. Upon this the Chief Conservator directed that the thinning should be confined to one coupe in each of the three ranges, in future. The series selected were Pannamalai in Ayyalur range, Mulaiyur in Natham range and Sirumalai South in Sholavandan range and the thinnings were executed in 1920. In 1928–29 coupes XI in Mulaiyur and Pannamalai series were thinned.

338. Mr. T. A. Whitehead inspected the results of thinnings in the coupes as well as in the experimental plots in 1929 and 1930. He examined the Mudimalai experimental plot and thought that the yield of wood in the adjacent unthinned area (no control plots had been laid out) was no less than in the thinned plot ; he measured samples in Mulaiyur coupes XI and XII. His conclusions were recorded as follows :—

> " that many shoots die on each stump when they are as thick as one's finger ; that this natural thinning is universal where a stump produces many shoots ; that the best shoots on an unthinned stump are in no way inferior to those on a thinned stump ; that owing to the greater number of shoots in the former the yield of wood at the end of the rotation is likely to be greater ; and that consequently the time and money spent on thinning out shoots is likely to be wasted ."

339. Mr. Whitehead, however, considered that definite conclusions could be arrived at by experimenting on *individual* stumps, with control stumps of the same size and vigour. This experiment was inaugurated in 1929 in the following coupes :—

Coupe III—Pannamalai felled in 1919–20.
Coupe IX—Pannamalai felled in 1915–16
Coupe VIII—Pannamalai felled in 1914–15.
Coupe IV—Sirumalai South felled in 1920–21.
Coupe XIV—Sirumalai South felled in 1915–16.
Coupe XV—Mulaiyur felled in 1919–20.

Half-acre plots were opened in each of these coupes and demarcated by cut lines and cairns at corners and subdivided into two. In one half the *Albizzia* coppice shoots were thinned leaving two shoots marked A and B in each stool and the girths and heights of these shoots were recorded. In the other half the two best shoots were selected and marked A and B and were measured but no thinning was done.

Definite results are expected from these plots in 15 or 20 years.

340. In Chief Conservator's Proceedings No. 356, dated 2nd September 1929, the thinning of coppice shoots of *Albizzia amara* in fuel coupes was considered unnecessary and was suspended pending the revision of the working plan.

341. *Experiments by the Working Plans division—Natural regeneration of Albizzia amara from seed.*—Two experimental plots were laid out in the Anjukulipatti fuel series with a view to see if natural regeneration of *Albizzia amara* from seed could be induced by a light burn of the seed-bed. Seedbearers were left standing in one of the plots and the rest of the growth was cut and burnt. The second plot was clear felled and burnt after seedfall. A good number of seedlings appeared in the first plot after the burn and have become established, with the help of weeding and tending. The results in the second plot were nil. No final conclusions can, however, be drawn from this except without repeating it, as the months that followed the treatment of the second plot have been unusually dry.

342. *Rab sowings in fuel coupes.*—The undermentioned species were sown in 1933 (September) in " rab " lines and patches in experimental plots in the Anjukulipatti fuel series : *Cassia siamea, Acacia ferruginea, Acacia planifrons, Cassia marginata, Acacia auriculiformis, Albizzia lebbek* and *Albizzia amara*. The results were satisfactory, *Cassia siamea, Acacia ferruginea* and *Acacia planifrons* having attained a maximum height of 8

feet ; and *Albizzia lebbek* and *Acacia auriculiformis* have grown up to 4 feet, and *Albizzia amara* to 3 feet by July 1935. Many seedlings of *Acacia auriculiformis* perished on account of the unusually dry year following the sowings. A defoliating caterpillar was observed on the *Acacia ferrugenea*. The *Cassia marginata* seedlings are only about a foot high.

343. *Cuttings of Albizzia amara.*—Early in 1933, thirty cuttings of *Albizzia amara* were planted in the Ambaturai fuel series, with a view to test if the tree can be grown from cuttings. Twelve of the cuttings had put forth shoots by 13th May 1933. Further observation could not be continued as all the cuttings were stolen soon after. The experiment was not repeated.

344. *Teak planting in Periaruvi valley* (*Alagar Hills*).—Teak seeds were sown in two nurseries about the middle of August 1933. Four hundred and twenty stumps from these nurseries were planted out at an espacement of 6′ × 6′ on 29th June 1934, on a small clearfelled plot adjacent to the perennial stream in the northern valley of the Alagar Hills R.F., slash first being burnt in patches. Half the number of stumps were planted in prepared pits and the other half in crowbar holes. In February 1935 there were 209 survivals, the maximum height being 4½′. The stumps planted in prepared pits were taller on the average than those in crowbar holes. The year has been an unusually dry one. Some damage was caused to the plants by a local herd of bison. Casualties were replaced on 15th October 1934, with stumps.

345. *Planting of Bamboos.*—Rhizomes of *Dendrocalamus strictus* 4–5 years old were obtained from the District Forest Officer, North Coimbatore, and of *Bambusa arundinacea* from the District Forest Officer, South Coimbatore, in October 1933. They were planted out soon after in four different localities, the *Dendrocalamus* on the Karandamalais and Sirumalai plateaux and the *Bambusa* in their valleys. Many of them sprouted but most failed to survive the following hot weather. Those that survived were subsequently destroyed by bison and fire. Effective protection against bison is essential for successful bamboo propagation.

346. *Canes* (*Calamus sp.*).—About a hundred rhizomes of a local species of cane were planted along the banks of the perennial stream in the northern valley of the Alagar Hills on 11th June 1934. In December 1934 there were ten survivals.

347. *Seed Germination Tests.*—Tests made on the percentage of germination of various seeds gave the following results :—

(1) *Albizzia amara*—82 per cent.
(2) *Albizzia lebbek*—45 per cent.
(3) *Acacia ferruginea*—52 per cent.
(4) *Cassia montana*—32 per cent.
(5) *Acacia auriculiformis*—16 per cent.

Kumri regeneration.

348. With a view to evolve a cheap method of regenerating degraded types of fuel forest, such as abandoned cultivation, which have been included in reserved forest and areas heavily overworked in the past for a combination of purposes (fuel, grazing, goat-browsing and removal of manure leaves) an attempt was made by the writer in 1933, with the co-operation of the Range Officer, Ayyalur, to regenerate 3 acres of a poorly stocked fuel forest in combination with field crops, i.e., by the well-known method of "Kumri". The area was handed over to the *kumridar* in June 1933, for felling and burning of slash, which was completed by the end of August. The ground was then prepared for the reception of the field crop by means of hoes and pickaxes. Strips three feet broad and spaced 22 feet from centre to centre were laid out over the area and the two ends of each strip were staked. Three lines six inches apart from one another were then sown with seeds of *Acacia planifrons, Albizzia amara, Tamarindus indica, Melia indica, Albizzia lebbek, Cassia marginata* and *Chloroxylon swietenia,* in the centre of each strip. Only one species was sown in each line making three different species for each strip. In the intervening space between the strips seeds of the agricultural crop were sown—the species used being *ragi* (*Eleusine Coracana*) *kambu* (*Pennisetum typhoides*), *thenai* (*Setaria italica*), and *cholam* (*Sorghum vulgare*). The sowings were completed by the middle of October.

The tree seedlings were kept weeded by the kumridar till he reaped his harvest in February 1934. Just before he removed his crop the kumridar was directed to loosen the soil round the tree seedlings.

The germination was good and the lines were full of seedlings at the time of the harvest. During the succeeding hot weather, however, a good proportion appeared to dry up and it was considered necessary to repeat the operation in order to obtain a satisfactory stocking.

349. The area was therefore handed back to the kumridar in August 1934 for raising a second field crop. The kumridar cut back all coppice shoots and burned them in heaps between the strips of tree seedlings and prepared the soil as before. More seeds were dibbled in the strips by the middle of September wherever the stocking was considered to be defective and the field crop was also sown at the same time. The species of field crops sown this time were *samai* (*Panicum miliare*) and *thenai* (*Setaria italica*).

The kumridar kept our seedlings weeded as before till he harvested his crop in February 1935. He then vacated the area after loosening the soil round the tree seedlings.

350. As soon as the rains commenced in September 1934, it was found that many of our seedlings which were considered dead were actually alive. They put forth new leaves and started growing fast and it was soon apparent that all the strips had sufficient seedlings in them. In fact there was scarcely a gap noticeable in many of the lines. An enumeration in March 1935 showed the following numbers of established seedlings :—

Acacia planifrons	..	6,809	seedlings.
Melia indica ..	..	920	,,
Tamarindus indica	..	412	,,
Cassia marginata	..	473	,,
Albizzia amara	..	118	,,
Chloroxylon swietenia.		5	,,
Total	..	8,737	seedlings.

Acacia planifrons had done best both in the number of survivals and in rapidity of growth—some of the plants were two feet high—but the species has a spreading habit. *Melia* had done very well, most of the seedlings being 2′ to 3′ high. It was also observed that *Acacia planifrons* had suppressed most of the seedlings of the species sown along side of it, on account of its spreading habit, with the exception of *Melia indica* which had been able to shoot ahead of the former.

351. The experiment was repeated in 1934 over an area of 5 acres of good fuel forest with a stand of 7 to 8 tons per acre. The locality was reasonably flat so that it could be ploughed. Felling and burning was completed by July 1934 and the field crop as well as the tree seeds were sown at the end of September 1934. The species of field crop sown were *ragi* (*Eleusine coracana*) and *thenai* (*Setaria italica*) : *Acacia planifrons, Albizzia lebbek, Cassia marginate, Tamarindus indica, Melia indica* and *Chloroxylon swietenia* were sown in the strips. The field crop was harvested in Febraury 1935. The survivals in March 1935 were :—

Acacia planifrons	..	5,593	Seedlings.
Tamarindus indica	..	866	,,
Chloroxylon swietenia.		701	,,
Melia indica ..	..	416	,,
Cassia montana	..	260	,,
Albizzia lebbek	..	144	,,
Total	..	7,980	seedlings.

It was observed that the presence of a large quantity of slash in this area had resulted in the death of several stumps. However, the results of this second experiment can be gauged properly only at the end of the second season. It must be noted here that the season 1934–35 was an exceptionally dry one.

352. *Financial results.*—The tree seeds were sown by the forest subordinates so that no expenditure was involved in these operations except the cost of collection of seeds.

The crops harvested by the kumridars were valued as follows :—

Three-acre experimental plot.

	RS.	A.	P.
Value of crop and straw in 1934	46	0	0
Value of crop and straw in 1935	69	8	0
Total	115	8	0.

Five-acre experimental plot.

	RS.	A.	P.
Value of crop and straw in 1935	305	0	0

The labour employed by the kumridars has not been taken into account ; but the fact that they are prepared to take fresh areas for regeneration indicates that the business must have been profitable to them.

353. This method of regeneration was also applied to some 7 acres of bare land in the Perumalai Reserve of the Natham range, on a suggestion put forward by the writer. The land in question was discovered to be encroachments into the reserve and the occupants were ejected in consequence. The quandom occupants were induced to cultivate the area in 1933, in combination with tree crops. The work was not supervised properly, but yet we have now an appreciable number of seedlings of *Wrightia tinctoria, Cassia marginata, Acacia planifrons* and *Acacia latronum* on what was absolutely bare ground before.

354. An area of 51·5 acres in five coupes of the Ayyalur range, 50·24 acres in four coupes of the Natham range and 21 acres in one coupe of the Sholavandan range have been taken up for regeneration by this system, in 1935.

Lac culture.

355. The cultivation of lac on *Schleichera trijuga* was started in the Vannathiparai Valley in 1930, on an experimental scale. The preliminary experiments were commenced in January 1930 when selected branches on four trees and on coppice shoots on ten stools were inoculated with a maund (82 lb.) of brood lac obtained from Ranchi. The crop matured early in the following July but the yield was only 15 lb. as a result of adverse weather and a multitude of predators. The experiment was repeated by infecting more trees with fresh brood lac in the same month : this crop matured in January 1931 but was again severely damaged by predators.

The third experimental infection was carried out in January 1931 but this time sticks showing signs of the existence of predators were not used as brood ; yet the crop was much infested with predators. The results, however, showed that the infected trees belonged to the type which is considered to be a good lac host, that the climatic conditions were generally suitable, and that a thick encrustation could be produced in the locality.

356. The experiments described above were made on unpruned trees. It was decided to raise lac experimentally on pruned trees as well and with this object, twelve trees were pruned in February 1930, and some more from January to March 1931. The first experiment on pruned trees was commenced in June 1931 when one of the trees pruned in February 1930 was infected with $1\frac{3}{4}$ lb. of brood lac obtained from the local crop raised on unpruned trees. The brood used was carefully selected so as to be as free from predators as could be judged. This crop matured in December and the yield was 17 times the seed used. The second experiment consisted in infecting in December 1931, two trees pruned in February 1930 with selected brood lac (free from predators) obtained from the first experiment. This gave a well developed crop equal to nearly 16 times the brood used. The third and fourth experiments were continuations of the first and second, with modifications in methods of infection. The results confirmed those obtained in the preliminary experiments and also proved that if the brood lac used was reasonably free from predators of the lac insect, a thick encrustation of lac and a high yield ratio could be ensured if the trees were pruned.

357. Having thus proved the suitability of the local type of *Schleichera trijuga* and of the climate of the Vannathiparai Valley for the production of a good lac crop, it was decided to carry out experiments with a view to determine the financial aspect of lac production in the locality.

Starting with one maund of brood lac purchased from Ranchi, three crops were raised in succession, commencing in January 1932 and closing with July 1933. The brood lac harvested from the first crop was used to produce the second crop, and that from the latter produced the third and final crop.

The financial results of these experiments were very encouraging : details will be found in Chapter VI of Part I. However, as the price of lac had slumped very low by this time, further operations were restricted to a scale which would enable the local brood to be conserved with a view to allow of expansion when the market showed signs of improvement. Such restricted crops continued to be grown till the middle of 1934, when the increasing prices resulted in steps being taken to prepare a working plan for the extensive cultivation of lac in the Vannathiparai valley.

358. It is not often sufficiently realized that lac is not less valuable than sandalwood or teak, even at Rs. 30 a maund. The following comparative values will be found instructive :—

Seed lac at Rs. 30 a maund sells at Rs. 820 a ton.

Sandalwood averaged, in 1934, Rs. 896 a ton.

Teak at Rs. 3 a cubic foot, sells at only Rs. 150 a ton.

Whereas teak and sandal trees take 70 to 100 years to grow to exploitable size lac crops can be raised annually or biennially on host trees which are otherwise of little economic value.

359. Full details of the experiments in lac cultivation conducted in the Vannathiparai valley will be found in Appendix VIII to this Working plan, which also contains the detailed life history of the lac insect and a brief survey of the lac industry.

Roads, Buildings and Wells.

360. Three separate statements are appended below exhibiting separately the roads and bridlepaths, the buildings and the wells, in the Madura forest division, with their capital cost, year of construction, the average cost of annual repairs and other connected information.

(*a*) List of roads, bridlepaths, etc., in Madura division.

Serial number and name of road or path.	Length. M.	Length. F.	Capital cost. RS.	Year of construction.	Average annual cost of maintenance for five years ending 1934. RS.	Remarks.
			KODAIKANAL RANGE.			
1 Marianshola-Kavunji thence to the junction of motor road (bridle path).	9	3	1,548	1908	59	
2 Kavunji to Vandaruvu as far as the rest-house (bridle-path).	8	0	1,836	1909	164	
3 Vandaruvu–Marianshola New path (bridlepath).	9	0	1,845	1909	148	
4 Poombarai–Kukkal (bridle-path).	6	0	2,393	1903	115	
5 Berijem–Marianshola (bridle-path).	6	4	500	..	101	
			PALNI RANGE.			
Oddanchatram–Vadagadu road.	5	0	2,000	1905	500	
			CUMBUM RANGE.			
7 Highwavy bridlepath ..	5	1	3,492	1904	235	Partly maintained by the tea estate.
8 Vannathiparai Medakaran mettu (bridle-path).	4	2	250	1920	77	
9 Kuruvanuthu–Vannathiparai road.	4	2	2,353	1922	452	Gravelled.
			SHOLAVANDAN RANGE.			
10 Palamedu–Andipatty road ..	10	6	5,912	1909	332	6 miles gravelled road.
11 Sathiar Valley road	4	7	4,852	1920	212	1 mile 7 furlongs gravelled road.
12 Rajadani–Uthappanaickanur road.	7	0	3,445	1923	525	5 miles gravelled road.
13 Sirumalai–Anjukulipatty and its two extensions.	12	3	6,616	1920–28	300	2 miles gravelled road.
1 Konapatty village to Konapatty Fuel series road.	2	1	397	1930	75	1 mile gravelled road.
			AYYALUR RANGE.			
15 Ayyalur–Mungilkaradu ..	4	0	1,949	1907	130	2 miles 3 furlongs gravelled road.
16 Ayyalur–Senkurichi ..	9	0	6,207	1908	180	6 miles 1 furlong metalled and 1 mile 7 furlongs gravelled.
17 Ayyalur–Sendurai	11	1	7,334	1907	190	2 miles and 2 furlongs metalled and 4 miles 1 furlong gravelled.
18 Sendurai–Pillayarnatham ..	7	3	4,322	1913	175	5 miles 6 furlongs gravelled.
19 Senkurichi–Vadamadura ..	3	0	2,072	1906	195	1 mile 6 furlongs metalled and 1 mile 2 furlongs gravelled.
20 Kovilur-Thoppaswami-malai.	5	0	2,779	1921	145	2 miles 4 furlongs gravelled.
21 Kombai–Pillayarnatham ..	7	0	2,800	1908	125	
22 Bridlepath connecting Kalpatti-Puthanatham road with Kumarikatti road.	1	0	140	1912	..	
23 Cart-track from Vyampatti railway station to Kadapichampatti.	5	0	46	1912	130	
24 Kalpatty - Pillayarnatham road.	8	0	4,005	1919	215	3 miles gravelled.
25 Ayyalur–Thopaswamimalai south.	5	4	2,283	1929	200	1 mile 1 furlong gravelled.

Serial number and name of road or path.	Length.		Capital cost.	Year of construction.	Average annual cost of maintenance for five years ending 1934.	Remarks.
	M.	F.	RS.	RS.	RS.	
NATHAM RANGE.						
26 Kanavoipatti–Valayapatti ..	5	0	2,783	1918	140	5 miles gravelled.
27 Munnur–Vemburli road ..	3	4	2,313	1908	200	3 miles 4 furlongs gravelled.
28 Natham–Kuttupatty ..	5	0	2,620	1909	411	1 furlong metalled and 4 miles 7 furlongs gravelled.
29 Kuttupatty–Manakattur ..	3	4	2,313	1908	200	3 miles 4 furlongs gravelled.
30 Kuttupatti–Kosikurichi ..	5	5	3,326	1909	425	4 furlongs metalled and 5 miles 1 furlong gravelled.
31 Malayur road and its extension.	8	0	3,472	1913 & 1929	202	8 miles gravelled.
32 Arukkampatti–Madura–Natham road.	7	2	4,160	1909	250	3 miles 6 furlongs metalled and 2 miles 2 furlongs gravelled.
33 Sendurai–Kodagipatty ..	6	0	3,120	1909	320	
34 Senkurichi–Kanvoipatti road.	10	5	5,931	1908	720	2 miles metalled and 8 miles 5 furlongs gravelled.
35 Sendurai–Manakattur ..	4	0	3,000	1908	320	1 mile 2 furlongs metalled and 2 miles 6 furlongs gravelled.
36 Kodagipatti–Sengurichi ..	2	1	1,000	1912	240	2 miles 1 furlong metalled.

(*b*) List of buildings—Madura division.

Serial number and name of building.	Capital cost of construction.	Date of construction.	Average annual cost of maintenance for five years ending 1934.
	RS.		RS.
KODAIKANAL RANGE.			
1 Subordinate lines at Kavunji ..	1,145	1913	3
2 Do. Kukkal ..	403	1908	1
3 Do. Devadanapatty ..	429	1904	26
4 Do. Poombarai ..	971	1916	3
5 Do. Perumalmalai ..	626	1929	..
6 Ranger's quarters at Kodaikanal ..	3,156	1889	39
7 Range clerk's quarters at Kodaikanal ..	557	1891	19
8 Old rest-house at Marianshola ..	779	1895	69
9 New do. ..	3,679	1916	25
10 Rest-house at Kavunji ..	2,054	1905	37
11 Do. Kukkal ..	2,031	1903	33
12 Range office and store-room—Kodaikanal ..	2,771	1904	8
13 Park Lodge—Kodaikanal ..	2,753	1908	20
14 Rest-house at Devadanapatti ..	2,967	1906	32
15 Do. Pulathur ..	1,450	1909	15
16 Do. Vandaruvu ..	1,694	1909	44
17 Do. Poombarai ..	2,087	1909	39
18 Inspection shed at Santhanakanal ..	1,535	1913	..
19 Do. Vandaruvu ..	1,804	1929	7
20 Do. Vembadi ..	1,503	1913	3
21 Do. Pambar hill ..	1,017	1911	..
PALNI RANGE.			
22 Sub-lines at Thandigudy ..	1,034	1899	31
23 Do. Virupakshi ..	1,295	1908	..
24 Range quarters at Thandigudy ..	1,325	1892	26
25 Rest-house at Thandigudy ..	2,731	1892	63
26 Do. Pachalur ..	1,273	1898	22
27 Do. Virupakshi ..	1,763	1901	33
28 Do. Ganguvarodai ..	1,653	1915	16
29 Range office at Palni ..	1,969	1918	14
CUMBUM RANGE.			
30 Range quarters at Cumbum ..	2,530	1891	11
31 Range clerk's quarters at Cumbum ..	791	1893	11
32 Forester's quarters at Keelagudalur ..	901	1891	68
33 Sub-lines at Keelagudalur ..	1,124	1893	..
34 Do. Cumbum ..	987	1908	77
35 Do. Kombai ..	580	1912	34
36 Do. Narayanathevanpatty ..	2,064	1921	44
37 Do. Surulipatti ..	2,033	1920	35
38 Rest-house at Vannathiparai ..	2,984	1916	57
39 Range office at Cumbum ..	3,522	1892	13
40 Lac godown at Cumbum ..	{ 461 358	1893 1934-35. }	..

Serial number and name of building.	Capital cost of construction.	Date of construction.	Average annual cost of maintenance for five years ending 1934.
	RS.		RS.
SHOLAVANDAN RANGE.			
41 Range quarters at Andipatti	4,059	1919	52
42 Sub-lines at Andipatti	2,854	1919	30
43 Do. Palamedu	612	1906	17
44 Do. Rajagopalampatti	580	1908	16
45 Do. Ambathurai	1,331	1920	12
46 Do. Kachaikatty	985	1909	38
47 Do. Vikramangalam	980	1910	35
48 Do. Thimarasanaikanur	649	1911	15
49 Do. Rajadani	1,018	1913	36
50 Do. Endlaparai	612	1910	14
51 Do. Anjukulipatty	907	1919	17
52 Rest-house at Palamedu	1,340	1891	60
53 Do. Rajagopalampatti	1,502	1906	21
54 Do. Kalluthu	2,640	1919	21
55 Do. Rajadani	1,929	1921	9
56 Range office at Andipatty	2,905	1918	44
AYYALUR RANGE.			
57 Ranger's quarters at Ayyalur	1,415	1912	25
58 Peon's line at Ayyalur	360	1911	3
59 Sub-lines at Ayyalur	1,344	1907	39
60 Do. Malapatti	1,157	1919	26
61 Do. Pillayarnatham	570	1909	34
62 Do. Sendurai	1,688	1905	17
63 Do. Kombai	734	1908	16
64 Do. Puthur	2,459	1921	10
65 Do. Kalpatty (new)	432	1923	..
66 Do. Kalpatty (old)	1,377	1914	26
67 Do. Kadapichampatti	80	1912	..
68 Do. Pusaripatti	611	1925	..
69 Pony shed at Sendurai	351	1909	..
70 Forester's quarters at Manaparai	970	1930	26
71 Rest-house at Ayyalur	5,152	1902	29
72 Do. Sendurai	1,520	1907	34
73 Do. R. Kombai	1,769	1908	..
74 Do. Pillayarnatham	3,090	1912	36
75 Do. Kalpatty	1,808	1884 & 1923	96
76 Range office at Ayyalur	1,667	1919	20
NATHAM RANGE.			
77 Range quarters at Natham	4,633	1903	36
78 Sub-lines at Natham	2,415	1904	26
79 Do.	1,208	1914	20
80 Sub-lines at Vemburli	789	1906	54
81 Do. Kanavaipatti	1,007	1893	22
82 Do. Arukkampatti	1,111	1909	38
83 Do. Munnur	1,169	1912	17
84 Do. Kuttupatti	600	1908	33
85 Do. Sirugudi	700	1909	36
86 Do. Alampatty	995	1913	33
87 Do. Senguríchi	875	1907	39
88 Rest-house at Kanavaipatti	3,741	1891	30
89 Do. Vemburli	2,906	1905	52
90 Do. Arukkampatti	1,496	1910	13
91 Do. Munnur	1,101	1892	11
92 Do. Sengurichi	1,261	1905	51
93 Range office at Natham	3,331	1922	18
94 Inspection shed at Malayur	1,114	1920	..

(NOTE.—Rest-house includes outhouse, stable, kitchen, etc.)

(c) List of wells in the Madura division.

Serial number and location of well.	Cost of construction.	Year of construction.
	RS.	
KODAIKANAL RANGE.		
1 Devadanapatty	400	..
PALNI RANGE.		
2 Virupakshi	199	1909–10
3 Pachalur	193	1898–99
4 Thandigudy	100	1899

Serial number and location of well.	Cost of construction. RS.	Year of construction.
CUMBUM RANGE.		
5 Kombai	275	1920–21
6 Naranathevanpatty	275	1920–21
7 Surulipatty	245	1920–21
8 Vannathiparai	499	1930
9 Gudalur	300	..
10 Cumbum	300	1920
SHOLAVANDAN RANGE.		
11 Palamedu	200	1891
12 Andipatty	293	1918
13 Rajadani	210	1921
14 Anjukulipatty	370	1918
15 Kachakatty	100	1912
16 Kalluthu	330	1924
17 Vikkramangalam	242	1916
18 Endlaparai	250	1918
19 Rajagopalampatty	200	1908
AYYALUR RANGE.		
20 Pillayarnatham	167	1913
21 R. Kombai	200	1914
22 Kalpatty	75	..
23 Sendurai	100	1907
24 Ayyalur	200	1914
NATHAM RANGE.		
25 Kuttupatty	244	1913
26 Arukkampatty	260	1918
27 Natham (attached to Range quarters and sub-lines).	75	1918
28 Munnur	100	1918
29 Kanavoipatty	200	1912
30 Vemburli	200	1908
31 Natham (attached to forester's quarters)	100	1917

SECTION 6.—PROTECTION OF FOREST PRODUCE IN TRANSIT.

361. *Timber and Fuel.*—The transit of timber in parts of Madura district, including fuel in quantities greater than head-loads, is controlled by the Timber Transit Rules, Madura, printed at pages 316–321 of the Forest Manual. The rules apply to the area specified in Schedule ' A ', which covers parts of the Dindigul, Melur and Madura taluks and the whole of the Periyakulam taluk. These rules have had a salutary effect in acting as a brake on the speed at which the growth in the unreserves coming under the area covered by Schedule ' A ' has been disappearing. If Schedule ' A ' had been more comprehensive there is little doubt that the present condition of some of the unreserves would have been decidedly less unsatisfactory.

362. *Sandalwood.*—Theft of sandalwood from the reserves of the division was facilitated, prior to 1934, by the absence of any rules to regulate the transport of sandalwood under sections 35 and 36 of the Madras Forest Act ; the existence of saleable sandal trees in zamindari areas adjoining reserved forests and in private pattas combined with the increasing import of foreign sandalwood into the district served to increase the difficulties of protecting Government sandalwood. With a view, therefore, to control the traffic of sandalwood inside the Madura Forest division, a set of rules similar to those prevailing in the Salem and Trichinopoly districts were introduced from 1st June 1934 under the sanction of G.O. Ms. No. 880, Development, dated 29th June 1934. The effect of these rules can be properly gauged only after they have been in force for some time.

SECTION 7.—ADMINISTRATION.

363. The first attempt at systematic organization of the administration of the Madura forests was made in 1871 when the district was divided into two ranges, ' Kodaikanal ' and ' Palni,' one to the west of the line joining Devadanapatty village and Palni town, and the other to the east of it. A ' Superintendent ' was at the head of the two ' maistris ' in charge of the ranges.

364. In 1888, the district was divided into five ranges, indicated by Roman numbers as No. I Range, No. II Range, etc. Between 1888 and 1893, the ranges were baptised ' Cumbum, ' ' Kodaikanal, ' ' Tandigudy, ' ' Palamedu ' and ' Kanavaipatty.'

365. In 1904, the headquarters of the Kanavaipatty range were transferred from Kanavaipatty to Natham.

366. In April 1914, the Kodaikanal and Tandigudy ranges were reconstituted and the headquarters of the latter range were transferred to Palni. As a result of this reconstitution, the Kudiraiyar, Olianuthu, Poombarai-Vilpatti Valley, Velancombai and Karadikuttu reserves were transferred from the Kodaikanal range to the Palni range and the Maruthanathiar, Mankaradu, Southern Slopes, Arunkanal, Unjalnachi, Varattarkanal and Iruttarkanal reserves were transferred from the latter to the former.

367. The number of ranges were increased to six in 1916, when the 'Ayyalur,' 'Sholavandan' and 'Natham' ranges were formed out of the Kanavaipatty and Palamedu ranges. The new ranges and their headquarters were as follows :—

Range.	Head quarters.
1 Sholavandan	Andipatty.
2 Natham	Natham.
3 Ayyalur	Ayyalur.
4 Kodaikanal	Kodaikanal.
5 Palni	Palni.
6 Cumbum	Cumbum.

The Andipatty reserves and Agamalai were transferred from the Cumbum to the Sholavandan range as a result of this subdivision.

368. A redistribution of reserves was made among the various ranges in April 1920, according to which the Maruthanathiar, Arunkanal, Unjalnachi and Mulayar reserves were transferred from the Kodaikanal range to the Palni range ; the Murugamalai, Southern Slopes, Varattarkanal, Iruttarkanal and Mankaradu reserves from the Kodaikanal to the Sholavandan range ; the Sembatty and Perumalai reserves and parts of the Sirumalai and Erakalamalai reserves from the Sholavandan to the Natham range.

369. In June 1924 the following inter-range exchanges were effected :—

The Southern Slopes, Iruttarkanal, Varattarkanal, Mankaradu, Murugamalai, Agamalai and Tambirankanal were transferred from the Sholavandan to the Kodaikanal range ; the Sembatti hills and part of the Sirumalais (Valayapatti) from the Natham to the Sholavandan range ; the Sirumalai North-east and North-west Slopes, and part of Erakalamalai from the Ayyalur to the Natham range.

370. In the year 1926, the forests of the old Vyampatty range of the Trichinopoly district, covering an area of 40·45 square miles, were added to the Ayyalur range, when the Trichinopoly forest division was abolished.

The Sirumalai North-east and North-west Slopes reserves, except the part of Erakalamalai reserve transferred to the Natham range in 1924, were transferred to the Sholavandan range in 1927.

371. The whole of the Manjampatty reserve (Kodaikanal range) and portions of Kukal and Kudiraiyar reserves (Kodaikanal and Palni ranges) covering an extent of 36·42 square miles were transferred to the South Coimbatore division on the first of April 1935, as it was considered that they could be more efficiently administered by that division. It is understood that the Collectors of Coimbatore and Madura have taken steps to get the boundaries of their respective Revenue districts altered suitably so as to be in conformity with this alteration.

372. *District Forest Officers.*—The undermentioned officers have held charge of the Madura Forest division :—

List of Officers in charge of Madura Forests.

(Qualifying period for inclusion in this list is seven months continuously in charge.)

Year.	Serial number and name.	Rank.	Nett period of charge. Y. M. D.	Absence on leave or on other duty ; also intervals.
1860 about April ..	1 E. Sperschneider ..	Overseer of Madura forests.	4 11 0	
1865 March 28th ..	2 T. N. Turnbull ..	Sub-Assistant Conservator.	3 1 0	Interval—May to June 1868.
1868 June	3 Lieut. Fullerton ..	Deputy Conservator.	0 9 0	Interval—5th March 1869 to 13th May 1869.
1869 May 14th ..	4 Lieut. I. Campbell Walker.	Do.	1 7 9	Absent twice—30th August 1869 to 29th November 1869 and 17th November 1870 to 6th December 1870. Interval—15th April 1871 to 7th June 1871.

Year.	Serial number and name.	Rank.	Nett period of charge. Y. M. D.	Absence on leave or on other duty : also intervals.
1871 June 8th ..	5 R. Williams	Deputy Conservator.	3 10 18	
1875 April 26th ..	6 J. H. B. Brougham ..	Do.	3 1 0	Absent—20th August 1875 to 8th September 1875.
1878 June 10th ..	7 H. A. Gass	Do.	See after No. 8.	Absent—16th February 1882 to 7th April 1882.
1882 May 31st ..	8 F. E. Robinson ..	Assistant Collector.	1 2 25	
1883 August 25th ..	H. A. Gass	Deputy Conservator.	12 0 23	Absent—6th May 1884 to 5th August 1884, 13th August 1886 to 29th January 1888, 24th March 1889 to 14th April 1889 and 15th April 1890 to 14th May 1890. Interval — September 1893 to 16th November 1893.
1893 November 17th	9 T. P. Peake	Do.	3 6 25	Interval—11th June 1897 to 19th October 1897.
1897 October 20th ..	10 H. J. A. Porter ..	Do.	3 5 0	Absent—24th September 1900 to 23rd December 1900. Interval—June 1901 to 29th January 1902.
1902 January 30th ..	11 H. B. Bryant	Do.	10 0 11	Absent—8th October 1906 to 7th November 1906, 2nd January 1908 to 25th March 1908, 27th September 1910 to 27th December 1910 and 19th July 1911 to 5th December 1911.
1913 February 17th.	12 J. S. Scot	Do.	2 5 23	Absent—7th October 1914 to 7th November 1914 and 15th June 1915 to 16th August 1915.
1915 November 13th.	13 A. B. Jackson ..	Do.	3 5 0	Absent—7th November 1917 to 10th December 1917.
1919 May 16th ..	14 S. V. Devadasan ..	E.A.C.	1 5 5	
1920 October 22nd.	15 K. A. Chengappa	Do. ..	2 11 17	
1923 October 10th ..	16 H. R. M. Law ..	Deputy Conservator.	1 3 18	
1925 January 29th ..	17 D. F. Stileman	Do.	See after No. 18.	
1927 December 8th.	18 J. A. Master ..	Do.	See before No. 19.	Interval—13th March 1928 to 10th July 1928.
1928 July 11th ..	D. F. Stileman.. ..	Do.	3 2 0	Interval—4th November 1928 to 17th February 1929.
1929 February 18th.	J. A. Master	Do.	2 7 7	
1931 June 22nd ..	19 W. C. Hart ..	E.A.C. ..	1 0 22	
1932 July 15th ..	20 B. Janakiram Singh ..	Deputy Conservator.	0 8 7	
1933 March 23rd ..	21 J. H. Longrigg ..	Do.	..	Absent—14th September 1933 to 13th October 1933.

SECTION 8.—PAST YIELD.

373. The following statements exhibit the past yields from the forests of the Madura division for the period referred to in them :—

Statement showing the past removals of timber from the reserves of Cumbum range, Madura division.

(1919–1934.)

Year.	From fuel coupes in cubic feet.	From other areas in cubic feet.	Total in cubic feet.
1919–20	9,440	..	9,440
1920–21	4,120	..	4,120
1921–22	9,480	1,992	11,472
1922–23	2,600	2,526	5,126
1923–24	4,430	1,954	6,434
1924–25	4,000	3,977	7,977
1925–26	9,520	6,968	15,488
1926–27	6,400	4,949	11,349
1927–28	6,640	1,813	8,453
1928–29	13,160	550	13,710
1929–30	680	118	798
1930–31	2,016	246	2,262
1931–32	1,320	349	1,669
1932–33	1,880	300	2,180
1933–34	7,320	282	7,602

Past yield Fuel—(1917–18 *to* 1933–34).

Year.	Kodaikanal.			Palni.			Cumbum.		
	Area in acres.	Yield in tons.		Area in acres.	Yield in tons.		Area in acres.	Yield in tons.	
		Fuel.	Charcoal.		Fuel.	Charcoal.		Fuel.	Charcoal.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1917–18 ..	..	..	..	..	..	..	153	806	43
1918–19 ..	..	..	..	..	..	..	150	1,255	35
1919–20 ..	..	..	..	..	..	..	258	1,824	122
1920–21 ..	..	..	..	..	..	..	190	1,246	285
1921–22 ..	..	..	..	..	..	..	176	1,365	29
1922–23 ..	..	..	..	..	..	..	127	462	77
1923–24 ..	..	..	..	..	..	..	178	904	152
1924–25 ..	..	..	..	..	..	..	257	1,669	69
1925–26 ..	..	..	..	..	..	..	233	1,424	182
1926–27 ..	..	..	..	..	..	..	192	1,227	176
1927–28 ..	158	897	18	..	..	..	249	1,406	114
1928–29 ..	172	1,159	21	..	..	..	299	1,901	83
1929–30 ..	207	753	..	..	..	..	283	1,209	69
1930–31 ..	223	1,337	..	49	98	..	236	1,248	78
1931–32 ..	151	475	..	17	58	..	256	1,385	..
1932–33 ..	238	633	..	44	290	..	279	3,895	..
1933–34 ..	163	905	43	77	296	..	262	2,044	633

Year.	Sholavandan.			Ayyalur.			Natham.		
	Area in acres.	Yield in tons.		Area in acres.	Yield in tons.		Area in acres.	Yield in tons.	
		Fuel.	Charcoal.		Fuel.	Charcoal.		Fuel.	Charcoal.
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1917–18 ..	724	1,980	43	507	3,531	..	914	6,807	..
1918–19 ..	608	1,619	140	362	2,744	..	937	5,569	..
1919–20 ..	755	2,817	18	785	5,603	235	845	6,330	..
1920–21 ..	592	2,672	..	1,125	7,134	5	1,000	5,761	..
1921–22 ..	831	2,467	1,206	1,149	8,036	..	718	3,778	..
1922–23 ..	904	1,818	805	978	5,998	..	836	5,191	..
1923–24 ..	1,024	5,751	..	651	4,309	89	646	3,863	..
1924–25 ..	813	4,963	..	345	2,578	..	780	5,603	76
1925–26 ..	1,030	5,582	..	1,216	5,960	500	1,021	6,085	..
1926–27 ..	954	5,039	..	1,187	6,526	681	1,138	6,360	..
1927–28 ..	853	4,530	..	1,131	5,262	192	1,206	7,526	..
1928–29 ..	709	4,073	..	1,134	6,420	63	1,452	7,499	..
1929–30 ..	813	4,156	..	1,184	7,275	115	1,344	11,080	..
1930–31 ..	877	4,597	..	1,093	7,384	..	1,266	9,975	..
1931–32 ..	1,040	6,056	..	1,045	8,130	..	1,333	11,638	..
1932–33 ..	926	6,011	..	969	8,106	..	1,227	9,132	..
1933–34 ..	846	4,796	..	..	..	..	921	6,268	..

Statement showing the quantity of bamboos removed from the Bamboo coupes of Kodaikanal, Palni and Cumbum ranges from 1931–32 *to* 1933–34 (*for three years*).

	1931–32.		1932–33.		1933–34.	
	Plain Bamboos.	Split Bamboos.	Plain Bamboos.	Split Bamboos.	Plain Bamboos.	Split Bamboos.
Kodaikanal range—						
Periyakulam series	4,295	4,205	43,919	6,657	20,107	5,431
Devadanapatti series	7,349	277	11,543	897	5,158	2,520
	HEAD LOADS.	HEAD LOADS.	HEAD LOADS.	HEAD LOADS.	HEAD LOADS.	HEAD LOADS.
Palni range—						
Palni series	5,910	737	3,203 and 100 cart loads.	1,797	7,272 and 4 cart loads.	2,300
Vennilai and Siruvatkadu series ..	3,000	2,000	4,867	933	3,700	2,900
Cumbum range—						
Surulipatty bamboo coupe	No coupe was sold.		No coupe was sold.		23,000 bamboos.	

SECTION 9.—PAST REVENUE AND EXPENDITURE.

374. The following statements exhibit the revenue and expenditure for the **Madura** forest division from 1916–17 :—

Statement of Past Revenue—Rangewar.

Year.	Reserves.						Unreserves—All sources.	Total.
	Timber.	Firewood.	Bamboo.	Grazing.	Minor forest produce.	Other sources.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
				Sholavandan Range.				
1916–17	1,609	6,627	..	6,290	4,035	1,414	..	19,975
1917–18	477	10,909	..	7,797	4,297	3,574	..	27,054
1918–19	2,365	16,209	..	6,834	2,522	5,321	..	33,251
1919–20	4,102	8,356	586	4,858	6,344	8,835	..	33,081
1920–21	2,558	9,447	..	7,422	2,008	4,093	..	25,528
1921–22	4,395	10,891	..	4,706	3,492	3,683	..	27,167
1922–23	1,910	10,429	176	5,895	3,913	5,252	..	27,575
1923–24	3,093	13,740	748	4,432	6,595	4,656	..	33,264
1924–25	3,640	6,238	684	5,350	6,348	4,662	..	26,922
1925–26	5	8,580	..	5,811	397	3,356	7,369	25,518
1926–27	39	5,337	29	3,458	199	3,324	5,715	18,101
1927–28	21	6,629	..	4,511	592	3,329	11,264	26,346
1928–29	24	9,553	..	4,286	728	2,776	5,937	23,304
1929–30	..	10,577	..	4,196	401	2,680	3,988	21,842
1930–31	..	14,700	..	4,142	583	2,405	3,452	25,282
1931–32	..	13,839	..	3,622	578	3,167	2,402	23,608
1932–33	2	11,479	..	3,730	418	4,760	1,705	22,094
1933–34	103	12,303	..	3,683	745	4,072	3,044	23,950
				Natham Range.				
1916–17	4	163	..	..	149	166	..	482
1917–18	487	9,191	..	3,853	6,759	2,911	..	23,201
1918–19	588	13,664	192	3,185	1,772	5,637	..	25,038
1919–20	4,122	8,356	586	4,858	6,324	8,832	..	33,078
1920–21	2,904	12,676	..	6,620	8,918	1,953	..	33,071
1921–22	6,299	11,784	1,760	5,507	5,418	4,318	..	35,086
1922–23	2,329	11,943	167	4,614	9,431	4,248	..	32,732
1923–24	3,093	13,740	748	4,432	6,595	4,655	..	33,263
1924–25	3,640	6,236	682	5,350	6,348	4,660	..	26,916
1925–26	16	9,082	120	4,109	3,290	5,232	10,675	32,524
1926–27	10	9,255	356	4,751	3,882	4,521	9,473	32,248
1927–28	40	24,952	..	5,296	3,582	4,699	9,254	47,823
1928–29	..	22,597	1	6,272	4,976	4,498	9,637	47,981
1929–30	..	41,873	..	6,095	4,227	8,056	9,736	69,987
1930–31	..	32,241	..	5,480	4,955	4,326	7,592	54,594
1931–32	..	31,177	..	4,358	2,940	4,487	4,099	47,061
1932–33	2	21,660	..	4,918	2,059	5,668	4,352	38,659
1933–34	16	18,659	..	4,574	1,678	6,278	3,064	34,269
				Ayyalur Range.				
1916–17	1,927	15,407	..	5,099	8,735	3,524	..	34,692
1917–18	10,218	15,929	..	4,632	5,601	5,088	..	41,468
1918–19	5,527	18,632	..	4,390	935	6,326	..	35,810
1919–20	4,102	8,358	588	4,858	6,344	8,835	..	33,085
1920–21	2,509	23,925	..	4,801	9,247	2,690	..	43,172
1921–22	3,510	52,554	..	3,355	6,697	6,054	..	72,170
1922–23	3,528	40,065	..	3,262	6,264	3,601	..	56,720
1923–24	3,093	13,740	748	4,432	6,595	4,656	..	33,264
1924–25	3,640	6,237	684	5,350	6,348	4,662	..	26,921
1925–26	212	27,044	..	4,142	2,804	3,923	7,580	45,705
1926–27	322	27,324	30	7,532	4,933	3,993	24,617	68,751
1927–28	..	37,964	..	6,536	3,428	4,905	25,410	78,243
1928–29	1,482	30,798	..	7,563	6,033	4,099	27,789	77,764
1929–30	..	51,964	..	7,556	2,547	3,131	30,587	95,785
1930–31	..	37,619	..	6,384	3,058	4,410	22,146	73,617
1931–32	..	45,292	..	5,519	1,296	2,790	16,294	71,191
1932–33	2	20,645	..	5,747	405	5,357	13,407	45,563
1933–34	17	664	..	6,381	1,228	4,662	16,015	28,967
				Kodaikanal Range.				
1916–17	722	1,861	361	2,303	8,892	1,072	..	15,211
1917–18	819	1,998	176	2,471	10,263	1,675	..	17,402
1918–19	1,310	2,887	..	2,305	2,723	10,796	..	20,021
1919–20	3,076	6,268	440	3,643	4,758	6,622	..	24,807
1920–21	164	1,177	167	542	7,089	820	..	9,959
1921–22	198	1,708	352	673	6,661	2,222	..	11,814
1922–23	1,032	417	304	912	4,415	1,251	..	8,331
1923–24	2,320	10,305	561	3,324	4,945	3,493	..	24,948

Kodaikanal Range—cont.

Year.	Reserves.						Unreserves—All sources.	Total.
	Timber.	Firewood.	Bamboo.	Grazing.	Minor forest produce.	Other sources.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
1924–25	2,732	4,679	512	4,012	4,762	3,495	..	20,192
1925–26	1,281	1,639	613	2,137	2,538	4,042	1,915	14,165
1926–27	10	2,284	347	1,851	2,210	3,397	1,635	11,734
1927–28	1,326	1,823	980	2,309	5,956	4,535	4,428	21,357
1928–29	1,483	3,227	920	2,327	4,433	3,016	3,578	18,984
1929–30	1,040	2,581	708	2,110	8,093	2,773	4,297	21,602
1930–31	498	3,624	711	1,942	7,041	2,667	3,014	19,497
1931–32	811	2,021	798	1,699	6,199	3,693	1,397	16,618
1932–33	924	3,012	923	1,698	17,300	2,076	1,015	26,948
1933–34	459	2,550	1,110	1,645	14,904	3,481	2,079	26,228

Palni Range.

1916–17	1,317	538	1,690	2,246	9,399	476	..	15,666
1917–18	1,164	431	2,855	2,482	12,461	612	..	20,005
1918–19	3,813	1,381	2,541	2,211	6,561	8,392	..	24,899
1919–20	3,073	6,267	439	3,645	4,759	6,623	..	24,806
1920–21	1,192	678	1,825	1,731	8,756	1,251	..	15,433
1921–22	2,080	977	2,421	2,051	11,395	2,012	..	20,936
1922–23	916	919	2,131	2,487	10,540	2,398	..	19,391
1923–24	2,319	10,305	560	3,324	4,945	3,492	..	24,945
1924–25	2,732	4,679	512	4,012	4,761	3,492	..	20,188
1925–26	330	856	1,488	3,189	10,050	2,203	2,244	20,360
1926–27	85	264	1,650	3,588	6,955	1,611	3,971	18,124
1927–28	..	200	1,503	3,249	10,758	1,578	5,778	23,066
1928–29	302	1	2,293	3,688	9,888	1,208	6,053	23,433
1929–30	206	150	2,035	3,522	12,190	1,985	3,179	23,267
1930–31	51	422	2,242	3,119	10,936	960	2,888	20,618
1931–32	3	387	2,107	2,865	11,522	454	835	18,173
1932–33	296	523	1,680	3,039	15,522	850	1,391	23,301
1933–34	75	556	1,983	3,014	12,590	1,674	2,296	22,188

Cumbum Range.

1916–17	610	3,418	280	5,399	1,457	810	..	11,974
1917–18	189	1,581	..	3,874	1,183	1,655	..	8,482
1918–19	4,092	5,026	281	3,447	956	2,256	..	16,058
1919–20	2,051	4,178	293	2,429	3,175	4,415	..	16,541
1920–21	2,438	1,762	252	3,174	1,201	1,715	..	10,542
1921–22	1,018	4,818	632	4,233	3,089	6,031	..	19,821
1922–23	5,346	2,597	691	5,786	1,108	2,147	..	17,675
1923–24	1,546	6,870	374	2,216	3,296	2,327	..	16,629
1924–25	1,821	3,119	342	2,675	3,174	2,330	..	13,461
1925–26	7,738	4,975	510	5,762	923	3,537	1,009	24,454
1926–27	57	10,001	227	5,318	756	3,327	1,295	20,981
1927–28	6,732	6,577	261	5,798	432	2,715	1,520	24,035
1928–29	4,034	7,180	77	4,373	631	2,981	2,160	21,436
1929–30	1,632	8,107	..	3,506	1,975	4,590	1,322	21,132
1930–31	1,505	3,741	4	3,412	1,905	5,205	1,221	16,993
1931–32	2,920	3,164	6	3,314	1,764	2,917	538	14,623
1932–33	1,101	3,239	15	3,413	2,627	3,162	991	14,548
1933–34	1,478	3,434	670	3,698	2,840	2,688	1,096	15,904

Summary of Past Expenditure—Rangewar.

Year.	Capital.		Conservancy, maintenance and regeneration.								Establishment.		Total.
	Demarcation.	Other charges.	Timber.	Roads and bridges.	Buildings.	Other works.	Regeneration.	Fire protection.	Stores, tools and plant.	Miscellaneous.	Pay and allowances.	Contingencies.	
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
						Sholavandan Range.							
1916–17 ..	987	..	760	1,585	388	4,158	..	1,042	100	23	9,595	611	19,249
1917–18 ..	568	793	979	2,584	4,053	2,470	..	754	74	50	11,054	559	23,938
1918–19 ..	872	49	884	4,034	6,148	3,549	..	806	741	39	11,082	491	28,695
1919–20 ..	188	233	762	3,352	2,146	2,971	673	924	..	..	9,560	1,294	22,103
1920–21 ..	82	..	844	1,789	1,491	1,385	..	838	139	..	9,846	324	16,738
1921–22 ..	131	15	910	2,791	1,192	1,822	..	775	24	..	12,560	521	20,741
1922–23 ..	..	..	774	668	408	1,174	..	256	92	8	13,765	500	17,645
1923–24 ..	64	..	2,867	2,011	578	52	38	451	74	48	13,548	569	20,300
1924–25 ..	172	403	3,293	2,577	376	91	73	407	9	87	13,870	524	21,882
1925–26 ..	..	242	2,066	1,748	445	12	..	95	1	21	13,350	391	18,371
1926–27 ..	174	32	2,204	1,897	570	..	8	253	5	..	14,687	609	20,439
1927–28 ..	..	1,568	2,464	1,507	536	50	..	158	24	..	16,608	483	23,398
1928–29 ..	..	2,350	2,701	1,119	279	25	..	156	21	..	14,881	672	22,204
1929–30 ..	173	394	2,543	2,438	531	28	..	156	..	..	16,259	809	23,331
1930–31 ..	..	580	2,527	1,984	349	50	..	156	4	15	16,041	740	22,446
1931–32 ..	..	25	2,279	1,297	401	71	9	156	..	53	12,692	763	17,746
1932–33 ..	..	165	2,253	1,548	427	44	121	151	13	48	12,407	775	17,952
1933–34 ..	..	185	2,285	1,610	290	..	162	158	17	86	13,776	771	19,340
						Cumbum Range.							
1916–17 ..	..	..	683	244	838	1,500	..	2,373	3	206	9,198	369	15,414
1917–18 ..	15	140	480	349	2,011	785	..	2,032	11	7	8,035	344	14,209
1918–19 ..	..	..	426	230	1,962	993	210	1,668	121	201	5,541	247	11,599
1919–20 ..	96	116	378	1,676	1,073	1,395	336	462	91	3	4,784	647	11,057
1920–21 ..	136	..	1,038	263	1,083	1,510	1,354	675	69	75	9,928	266	16,397
1921–22 ..	265	7	1,364	2,008	1,422	888	1,600	927	26	164	13,796	405	22,872
1922–23 ..	..	..	2,123	681	447	803	888	891	66	200	10,825	325	17,249
1923–24 ..	32	..	1,434	1,006	290	27	19	225	1	61	6,775	286	10,156
1924–25 ..	28	263	1,648	1,288	188	63	37	284	5	27	6,936	263	11,030
1925–26 ..	..	..	5,730	563	835	46	..	414	1	..	11,057	316	18,962
1926–27 ..	294	47	4,957	1,334	652	210	4	390	2	..	12,603	556	21,049
1927–28 ..	..	463	3,626	1,184	320	52	8	296	67	35	13,483	462	19,996
1928–29 ..	..	607	1,810	1,000	621	93	6	348	9	15	7,896	472	12,877
1929–30 ..	296	450	2,252	1,007	278	317	..	289	10	..	8,130	402	13,431
1930–31 ..	1,320	2,578	2,062	433	320	205	359	779	9	18	8,021	382	16,486
1931–32 ..	38	109	1,859	417	201	75	635	540	..	59	9,793	344	14,070
1932–33 ..	159	2	1,693	366	266	36	234	315	7	44	10,371	422	13,915
1933–34 ..	..	345	1,839	576	265	46	69	487	7	250	10,911	357	15,152
						Natham Range.							
1916–17 ..	..	..	53	..	17	112	..	60	..	..	4,970	366	5,578
1917–18 ..	123	17	748	2,631	1,473	1,759	..	525	25	..	10,912	606	18,819
1918–19 ..	141	6	488	1,474	1,600	3,069	..	542	667	2	11,081	490	19,560
1919–20 ..	..	424	756	3,352	2,146	2,789	673	924	188	..	9,565	1,294	22,111
1920–21 ..	..	10	776	788	470	1,005	..	588	138	173	9,258	413	13,619
1921–22 ..	..	1,937	546	3,012	4,169	2,448	..	911	40	20	13,551	447	27,081
1922–23 ..	398	..	819	2,211	379	2,361	25	761	91	33	13,482	437	20,997
1923–24 ..	64	..	2,867	2,011	578	98	38	451	5	72	13,551	569	20,304
1924–25 ..	172	403	3,292	2,576	376	91	73	407	8	88	13,868	524	21,878
1925–26 ..	..	1,478	2,676	2,917	399	..	398	..	10	33	13,646	498	22,055
1926–27 ..	..	177	2,865	2,781	945	40	7	234	4	..	13,962	801	21,816
1927–28 ..	42	71	2,655	3,773	714	1	2	244	30	18	19,722	946	28,218
1928–29 ..	1,099	492	3,037	3,916	794	42	..	195	18	..	14,472	645	24,710
1929–30 ..	146	..	3,047	3,695	727	50	..	244	..	..	16,259	806	24,974
1930–31 ..	350	416	3,097	3,678	395	33	..	246	..	..	16,041	740	24,996
1931–32 ..	279	25	2,578	3,478	501	27	44	246	..	58	15,086	693	23,015
1932–33 ..	48	5	2,546	2,876	521	3	122	246	10	189	13,878	685	21,129
1933–34 ..	..	11	2,326	2,975	548	17	280	246	13	94	16,462	653	23,625
						Ayyalur Range.							
1916–17 ..	386	348	778	1,723	703	2,917	..	..	54	17	11,309	489	18,724
1917–18 ..	900	19	540	3,735	3,679	3,066	..	192	20	..	10,882	462	23,495
1918–19 ..	778	564	639	4,881	3,002	3,130	..	181	221	1	11,081	491	24,969
1919–20 ..	188	233	756	3,352	2,146	2,649	673	924	188	140	9,563	1,294	22,106
1920–21 ..	59	44	693	3,557	1,111	2,107	..	863	139	..	9,392	318	18,283
1921–22 ..	146	452	622	7,291	1,090	2,812	41	1,110	34	35	12,116	507	26,256
1922–23 ..	..	..	623	3,059	423	1,893	..	438	131	35	13,660	513	20,775
1923–24 ..	64	..	2,867	2,011	578	49	38	451	2	121	13,550	569	20,300
1924–25 ..	172	403	3,292	2,576	376	123	73	407	8	55	13,868	524	21,877
1925–26 ..	..	..	1,975	5,065	402	45	..	70	1	19	10,990	406	18,973
1926–27 ..	..	32	2,119	3,234	656	175	8	60	17	..	17,522	1,111	24,934
1927–28 ..	..	169	1,581	2,549	504	20	..	70	21	36	14,724	551	20,225
1928–29 ..	..	585	2,835	2,749	717	45	..	70	31	..	14,305	626	21,963
1929–30 ..	23	271	2,638	2,885	373	51	..	70	..	..	16,260	809	23,380
1930–31 ..	4	556	2,703	2,868	516	..	3	80	6	6	16,041	740	23,523
1931–32 ..	..	25	2,269	2,634	494	25	..	80	..	53	12,780	635	18,995
1932–33 ..	..	375	2,060	2,459	307	..	145	80	9	48	14,701	641	20,825
1933–34 ..	..	10	1,975	3,030	312	39	116	80	14	81	15,474	643	21,774
						Kodaikanal Range.							
1916–17 ..	534	..	322	1,503	533	1,827	1,297	1,861	50	100	7,321	582	15,930
1917–18 ..	1,233	5	302	1,982	1,261	1,876	1,218	1,717	15	82	8,830	608	19,129
1918–19 ..	..	2	332	2,595	1,976	2,085	1,379	1,662	57	17	8,307	367	18,779
1919–20 ..	146	175	566	2,514	1,612	1,986	505	692	136	110	7,168	971	16,581
1920–21 ..	25	..	169	1,792	711	1,570	1,624	1,865	104	10	8,138	585	16,593
1921–22 ..	220	10	181	1,477	958	1,629	2,032	2,572	88	10	10,343	808	20,328
1922–23 ..	..	320	839	721	6	1,101	362	1,232	85	..	9,661	462	14,789
1923–24 ..	..	..	2,155	1,508	436	85	27	338	1	93	10,163	427	15,233
1924–25 ..	130	306	2,469	1,933	283	29	55	306	7	106	10,404	393	16,421
1925–26 ..	..	68	1,987	2,422	283	48	149	1,146	3	335	12,219	548	19,208
1926–27 ..	..	342	1,847	1,874	373	..	234	937	3	238	14,114	876	20,838
1927–28 ..	..	68	1,704	2,192	737	72	196	1,886	11	238	17,322	779	25,205
1928–29 ..	..	1,301	2,189	1,938	689	79	153	1,315	13	238	12,180	754	20,849
1929–30 ..	..	1,407	2,399	1,290	505	25	..	2,363	..	238	12,195	598	21,020
1930–31 ..	..	232	2,651	969	568	50	..	1,949	30	340	12,025	554	19,368
1931–32 ..	..	126	2,631	1,017	768	65	10	1,914	13	193	15,940	527	23,204
1932–33 ..	10	440	2,179	840	560	30	93	1,629	7	199	13,860	839	20,686
1933–3 ..	..	870	2,331	1,412	370	..	51	1,453	25	354	14,160	632	21,658

Year.	Capital.		Conservancy, maintenance and regeneration.								Establishment.		
	Demarcation.	Other charges.	Timber.	Roads and bridges.	Buildings.	Other works.	Regeneration.	Fire protection.	Stores tools and plant.	Miscellaneous.	Pay and allowances.	Contingencies.	Total.
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
						Palni Range..							
1916–17	1,121	..	211	764	118	1,135	..	..	..	..	7,397	543	11,289
1917–18	748	14	213	898	2,050	1,060	..	..	43	44	8,003	463	13,536
1918–19	427	..	363	870	80	1,236	..	386	107	4	8,303	367	12,143
1919–20	140	175	565	2,514	1,609	1,567	505	692	135	529	7,166	971	16,568
1920–21	77	..	207	642	191	1,239	..	343	104	97	7,712	324	10,936
1921–22	161	10	383	1,000	254	1,327	50	291	26	..	10,261	425	14,188
1922–23	..	..	423	776	203	1,379	133	150	64	6	10,928	475	14,537
1923–24	48	..	2,155	1,508	436	36	27	338	1	93	10,160	428	15,230
1924–25	130	305	2,470	1,933	283	69	55	306	7	65	10,402	392	16,417
1925–26	..	1	1,692	857	51	..	24	75	1	..	10,251	384	13,336
1926–27	..	24	1,707	690	107	..	6	100	5	..	11,190	748	14,577
1927–28	..	52	1,850	687	317	13	..	100	10	1	13,053	626	16,709
1928–29	..	39	1,895	687	297	48	..	94	13	..	11,303	538	14,914
1929–30	..	..	1,856	682	225	48	..	100	..	..	12,192	598	15,701
1930–31	..	91	2,017	1,187	315	48	..	346	30	..	12,025	554	16,613
1931–32	..	18	1,852	699	294	62	4	331	47	69	11,895	504	15,775
1932–33	30	3	1,760	207	93	31	6	333	9	50	11,289	532	14,343
1933–34	..	8	1,737	403	113	22	51	317	9	81	11,726	523	14,990

Summary of Past Revenue for Madura Division.

Year.	Reserves.						Unreserves—All sources.	Total.
	Timber.	Firewood.	Bamboos.	Grazing.	Minor Forest produce.	Other sources.		
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
1916–17	6,189	28,014	2,331	21,337	32,667	7,462	..	98,000
1917–18	13,354	40,039	3,031	25,109	40,564	15,515	..	1,37,612
1918–19	17,695	57,799	3,014	22,372	15,469	38,728	..	1,55,077
1919–20	20,526	41,783	2,932	24,291	31,704	44,162	..	1,65,398
1920–21	11,765	49,665	2,244	24,290	37,219	12,522	..	1,37,705
1921–22	17,500	82,732	5,165	20,525	36,752	24,320	..	1,86,994
1922–23	15,061	66,370	3,469	22,956	35,671	18,897	..	1,62,424
1923–24	15,464	68,700	3,739	22,160	32,971	23,279	..	1,66,313
1924–25	18,205	31,188	3,416	26,749	31,741	23,301	..	1,34,600
1925–26	9,582	52,176	2,731	25,150	20,002	22,293	30,792	1,62,726
1926–27	523	54,465	2,639	26,498	18,935	20,173	46,706	1,69,939
1927–28	8,119	78,145	2,744	27,699	24,748	21,761	57,654	2,20,870
1928–29	7,325	73,356	3,291	28,509	26,689	18,578	55,154	2,12,902
1929–30	2,878	1,15,252	2,743	26,985	29,433	23,215	53,109	2,53,615
1930–31	2,054	92,347	2,957	24,479	28,478	19,973	40,313	2,10,601
1931–32	3,734	95,880	2,911	21,377	24,299	17,508	25,565	1,91,274
1932–33	2,327	60,558	2,618	22,545	38,331	21,873	22,861	1,71,113
1933–34	2,148	38,166	3,763	22,995	33,985	22,855	27,594	1,51,506

Summary of Past Expenditure in Madura Division.

Year.	Capital.		Conservancy, maintenance and regeneration.								Establishment.		
	Demarcation.	Other charges.	Timber.	Roads and bridges.	Buildings.	Other works.	Regeneration.	Fire protection.	Stores tools and plant.	Miscellaneous.	Pay and allowances.	Contingencies.	Total.
	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
1916–17 ..	3,028	348	2,807	5,819	2,597	11,649	1,297	5,336	207	346	49,790	2,960	86,184
1917–18 ..	3,587	988	3,262	12,179	14,527	11,016	1,218	5,220	188	183	57,716	3,042	1,13,126
1918–19 ..	2,218	621	3,132	14,084	14,768	14,062	1,589	5,245	1,914	264	55,395	2,453	1,15,745
1919–20 ..	758	1,356	3,783	16,760	10,732	13,357	3,365	4,618	738	782	47,806	6,471	1,10,526
1920–21 ..	379	54	3,727	8,831	5,057	8,816	2,978	5,172	693	355	54,274	2,230	92,566
1921–22 ..	923	2,431	4,006	17,579	9,085	10,926	3,723	6,586	238	229	72,627	3,113	1,31,466
1922–23 ..	398	320	5,601	8,116	1,866	8,711	1,408	3,728	529	282	72,321	2,712	1,05,992
1923–24 ..	272	..	14,345	10,055	2,896	347	187	2,254	84	488	67,747	2,848	1,01,523
1924–25 ..	804	2,083	16,464	12,883	1,882	466	366	2,117	44	428	69,348	2,620	1,09,505
1925–26 ..	..	1,789	16,126	13,572	2,415	151	571	1,800	17	408	71,513	2,543	1,10,905
1926–27 ..	468	654	15,699	11,810	3,303	425	267	1,974	36	238	84,078	4,701	1,23,653
1927–28 ..	42	2,391	13,880	11,892	3,128	208	206	2,754	163	328	94,912	3,847	1,33,751
1928–29 ..	1,099	5,374	14,467	11,409	3,397	332	159	2,178	105	253	75,037	3,707	1,17,517
1929–30 ..	638	2,522	14,735	11,997	2,639	519	..	3,222	10	238	81,205	4,022	1,21,837
1930–31 ..	1,674	4,453	15,057	11,119	2,463	386	362	3,556	79	379	80,194	3,710	1,23,432
1931–32 ..	317	328	13,468	9,542	2,659	325	702	3,267	60	485	78,186	3,466	1,12,805
1932–33 ..	247	990	12,491	8,296	2,174	144	721	2,754	55	578	76,506	3,894	1,08,850
1933–34 ..	..	1,429	12,493	10,006	1,898	124	729	2,741	85	946	82,509	3,579	1,16,539

Statement showing the financial position in the past.

Year.	Summary of Revenue.	Summary of Expenditure.	Profit.
	RS.	RS.	RS.
1916–17	98,000	86,184	11,816
1917–18	1,37,612	1,13,126	24,486
1918–19	1,55,077	1,15,745	39,332
1919–20	1,65,398	1,10,526	54,872
1920–21	1,37,705	92,566	45,139
1921–22	1,86,994	1,31,466	55,528
1922–23	1,62,424	1,05,992	56,432
1923–24	1,66,313	1,01,523	64,790
1924–25	1,34,600	1,09,505	25,095
1925–26	1,62,725	1,10,905	51,820
1926–27	1,69,939	1,23,653	46,286
1927–28	2,20,861	1,33,751	87,110

Year.	Summary of Revenue.	Summary of Expenditure.	Profit.
	RS.	RS.	RS.
1928–29	2,12,902	1,17,517	95,385
1929–30	2,53,615	1,21,837	1,31,778
1930–31	2,10,601	1,23,432	87,169
1931–32	1,91,274	1,12,805	78,469
1932–33	1,71,113	1,08,850	62,263
1933–34	1,51,506	1,16,538	34,968

CHAPTER VI.—STATISTICS OF GROWTH AND YIELD.

SECTION 1.—FUEL.

375. *Deciduous forests.*—With a view to fixing the period of rotation for the majority of the fuel forests of the division sample plots were enumerated in coupes of known age. The areas and distribution of the plots measured are as tabulated below :—

Range.	Number of plots enumerated.	Total area of plots in acres.	Remarks.
Sholavandan	50	78·5	Minimum 0·4 acre. Maximum 5·4 acres.
Natham	31	70·4	Minimum 0·4 acre. Maximum 5·0 acres.
Ayyalur	25	34·6	Minimum 0·4 acre. Maximum 3·0 acres.
Kodaikanal	11	30·1	Minimum 2·5 acres. Maximum 4·0 acres.
Cumbum	29	20·8	Minimum 0·4 acre. Maximum 3·8 acres.
Total ..	**146**	**234·4**	

The girths at breast height of all coppice shoots of valuable fuel species were measured and tabulated.

Albizzia amara was found to be the most widely prevalent and the most predominant species, and its rate of growth was therefore taken as the basis on which to fix the rotation for all the fuel series in the deciduous forests. From the data collected curves were drawn showing the current and mean annual increments for this species.

A rotation of thirty years was adopted as the most suitable one, with reference to these curves and other relevant factors. Details will be found in paragraphs 524 to 527 of Chapter IV of Part II of this Working Plan.

The statistics and curves have been filed with working plan records.

376. *Eucalyptus globulus.*—An area of one acre of the *Eucalyptus* plantation in Gundan shola was clearfelled and coppiced in 1923–24. Measurements of girth at breast height were taken, in May 1935, of forty of the resulting coppice shoots. The mean of these measurements was found to be 19·9″. This compares favourably with the girth of 18·5″ recorded for shoots 11 years old on the Nilgiris—vide page 14 of Mr. Dyson's Revised Working Plan for the Nilgiris plantations, 1928.

377. *Acacia decurrens.*—Three-year old coppice shoots of *Acacia decurrens* near the subordinates' quarters in the Gundan shola *Eucalyptus* plantation were measured in May 1935. The mean of 63 measurements worked out to a girth of 9·3″ at breast height.

SECTION 2.—TIMBER.

378. *Quality of Teak Plantations.*--Height measurements of dominant and sub-dominant teak trees in the Vannathiparai and Velancombai teak plantations were taken and forwarded to the Provincial Silviculturist for assessment of their qualities. On the basis of these height measurements the two plantations were assessed as shown below :—

Age.	Plantation.	Average height.	Quality.
		FT.	
65 years	Vannathiparai	87·3	1·7 of III Nilambur.
65 years	Velancombai	95·2	0·6 of II Nilambur.

379. Ten teak trees planted in 1895 on private land on a canal bank just outside the reserved forests in the Iruttar valley of the Kodaikanal range were measured in 1934. Their average height was 55′ and the mean girth at breast height was 5 feet 5 inches. The Provincial Silviculturist has allotted them to IV quality, Nilambur. They are interesting in that they indicate what quality of teak may be grown under irrigation in this neighbourhood. It is proposed to form irrigated teak plantations, experimentally, in the Iruttar valley.

Enumeration in timber areas.

380. *Natham range.*—A complete enumeration of all trees of *Artocarpus hirsuta, Bischofia javanica* and *Mangifera indica* found in the valleys of the Karandamalais and Alagar Hills reserves was made. The *Artocarpus* was enumerated down to a minimum girth of one foot at breast height and the other two species down to three feet. The results are exhibited in the subjoined tabular statements :—

Enumeration of timber trees in the Natham range.

Karandamalai and Alagar Hill Reserves.

Species.	Locality.	Number of trees in girth class.										Total.
		1′–2′	2′–3′	3′–4′	4′–5′	5′–6′	6′–7′	7′–8′	8′–9′	9′10′	Over 10′	
Artocarpus hirsuta.	Karandamalais—											
	Aiyangodai valley.	16	18	18	14	12	12	7	6	7	11	121
	Kamukamgodai valley.	12	13	10	4	9	1	..	..	..	2	51
	Shengalunir valley.	14	17	20	15	12	12	7	7	1	10	115
	Kalanai North ..	50	64	44	23	19	5	4	6	6	15	236
	Kalanai East ..	18	30	31	21	12	4	4	3	4	3	130
	Alagar hills—											
	Periaruvi (North).	95	179	170	85	38	19	5	2	..	..	593
	Chinnaruvi (South).	1	5	4	2	6	2	..	..	..	11	31
	Total ..	**206**	**326**	**297**	**164**	**108**	**55**	**27**	**24**	**18**	**52**	**1,277**
Mangifera indica.	Karandamalais—											
	Aiyangodai valley.	..	..	21	22	20	30	21	18	8	68	208
	Kamukamgodai valley.	..	..	1	5	3	5	3	6	1	7	31
	Shengalnir valley.	..	..	27	16	17	18	11	17	13	14	133
	Mondimamaram valley.	..	..	..	..	3	3	1	2	1	3	13
	Kalanai North ..	..	..	44	19	20	10	18	4	10	26	151
	Kalanai East ..	..	..	33	20	13	7	5	5	3	18	104
	Alagar Hills—											
	Periaruvi (North).	..	..	60	62	46	34	20	6	6	45	279
	Chinnaruvi (South).	..	..	6	20	16	6	5	2	..	17	72
	Total ..	..	..	**192**	**164**	**138**	**113**	**84**	**60**	**42**	**198**	**991**
Bischofia javanica.	Karandamalais—											
	Aiyangodai valley.	..	..	2	3	9	2	1	..	1	3	21
	Kamukamgodai valley.	..	..	7	3	2	2	..	..	1	1	16
	Shengalanir valley.	..	..	3	5	2	5	3	1	..	3	22
	Kalanai (North)..	..	..	14	3	2	4	..	1	..	1	25
	Kalanai (East) ..	..	..	10	12	4	2	1	..	..	..	29
	Alagar Hills—											
	Periaruvi (North).	..	..	..	1	..	..	..	..	..	..	1
	Total ..	..	..	**36**	**27**	**19**	**15**	**5**	**2**	**2**	**8**	**114**

381. *Cumbum Range.*—Enumerations of all timber species above a breast height girth of three feet were also conducted in the timber forests of the Cumbum range, in strips 5 chains wide, running from end to end of selected areas. The areas selected were (1) the Surulipatty plateau, (2) the Vannathiparai valley, (3) the Suranganar valley and (4) at Machakal and Kombai ; the strips were only one chain wide in the last two localities as the timber areas were precipitous and of narrow width.

The strip lines were laid out with the American Compass and measured with the Trailer tape and Abney level. The following species were differentiated, all others being classified as ' miscellaneous ' :—

Teak, *Dalbergia latifolia, Pterocarpus marsupium, Albizzia odoratissima, Stereospermum chelonoides, Adina cordifolia, Schleichera trijuga, Grewia tiliaefolia, Shorea talura, Anogeissus latifolia* and *Terminalia chebula.*

The measurements were made with callipers divided into the following girth classes :—
3′–4′, 4′–5′, 5′–6′, 6′–7′, 7′–8′, 8′–9′, 9′–10′ and over 10′.

Enumeration figures for lengths of 20 chains along the strips were kept separate, i.e., for every 10 acres.

The forests were divided into two quality classes, Class I and Class II, based on height and density of the growth, and the enumeration figures for each of the two qualities were grouped together. The statement given below exhibits the percentage of the areas enumerated in the different localities mentioned above, to the respective total timber bearing areas :—

Statement showing the percentage of enumerations made in the Cumbum Range.

Locality.	Timber area in acres.		Area of sample plots enumerated in acres.		Percentage of enumeration.		Remarks.
	I class.	II class.	I class.	II class.	I class.	II class.	
Suruli plateau	480	2,310	62·5	97·2	13·1	4·2	
Vannathiparai valley, East.	605	3,039	63·2	92·2	11·0	3·0	These two valleys together form the Vannathiparai valley.
Poriparai valley ..	850	1,600	74·5	63·6	8·8	4·0	
Suranganar valley ..	..	1,774	..	20·0	..	1·1	These areas are poorly stocked ; hence the small percentage enumerated.
Machakal and Kombai.	..	3,100	..	25·2	..	0·8	

The total growing stock on the timber areas was evaluated on the basis of these enumerations. The values obtained will be found in Chapter II of Part II of this Working Plan.

SECTION 3.—LAC.

382. From the history of the lac crops raised at Vannathiparai between 1930 and 1934, statistics are available for the yield of lac (brood lac as well as the converted products) from kusum trees and its cost of production. The following statements summarise the results obtained :—

383. *Yield of brood lac from Kusum trees : artificial infection.*—The data given in the statement below relate to all the 9 crops that were raised on pruned trees since the commencement of lac operations at Vannathiparai. Trees infected by transfer of brood lac are not included.

Statement showing yield of brood lac from Kusum trees—artificial infection.

Crop period.	All trees.			Average per tree.		Brood yield ratio.
	Brood-lac used for infection.	Number of trees infected.	Brood-lac harvested.	Brood-lac used for infection.	Brood-lac harvested.	
	LBS.		LBS.	LBS.	LBS.	
June—December 1931 ..	1¾	1	29½	1¾	29½	1 : 17
December 1931—June 1932 ..	11	1	122	11	122	1 : 11
June—December 1932 ..	118	6	657	20	108	1 : 5·4
December 1932—June 1933 ..	320	12	2,026	27	169	1 : 6·3
January—June 1932	82	3	367	27	122	1 : 4·5
June—December 1932 ..	295	12	1,361	25	113	1 : 4·5
December 1932—June 1933 ..	869	34	1,509	25	52	1 : 2
June—December 1933 ..	268	10	1,220	27	174	1 : 7·2
December 1933—May 1934 ..	605	15	4,178	40	298	1 : 7
May 1934—November 1934 ..	1,423	44	9,870	32	224	1 : 7

It will be seen from the above that in all the crops except one the yield was nearly 5 to 16 times the seed used whilst in normal crops the yield is generally 3 to 4 times the seed. So all these crops may be considered to have been very successful. Even the poor summer crop of 1933 which was subject to adverse conditions gave a brood to yield ratio of 1 : 2.

The crop yield above 300 lb. from individual kusum trees in the last 3 harvests were 730, 643, 513, 475, 357, 345, 325, 325 lb. of brood lac.

384. *Yield of scraped lac from brood lac—(Stick lac).*—Stick lac was scraped within a few days of its cutting during December 1934. In each case a maund of stick lac was given to women coolies for scraping, and the scraped lac was weighed as soon as the stick lac was completely scraped.

The following figures give the result :—

Yield of scraped lac from brood lac.

Weight of stick lac in lb.	Weight of scraped lac in lb.	Weight of sticks. in lb.	Dryage in lb.
82	56·5	22·25	3·25
82	56	24·25	1·75
82	58	21·50	2·50
82	60	22·00	..
82	55·5	22·25	4·25
82	53·75	26·12	2·12

Brood lac and *ari* lac if stored will lose weight due to the drying up of green shoots and of the lac encrustation on them. The rate of dryage will, however, vary according to the thickness of encrustation, the size and number of gaps in it and the thickness of the shoots themselves as all the shoots and encrustations on them are not of uniform thickness.

385. *Yield of washed lac from brood lac—(Stick lac).*—The conversion ratios are worked out from the yield figures given in paragraph 383 for the artificial crop as well as for all crops. These ratios will enable the District staff to form an estimate of the probable yield of washed lac as soon as the crop is cut in the field.

Yield of washed lac from brood lac.

	Artificial crops.			All crops.		
	Stick lac.	Washed lac.	Ratio.	Stick lac.	Washed lac.	Ratio.
	LBS.	LBS.		LBS.	LBS.	
	367	131	2·8 : 1	538	189	2·8 : 1
	1,959	748	2·6 : 1	2,825	1,134	2·5 . 1
	1,509	429	3·5 : 1	4,342	1,230	3·5 : 1
	1,220	520	2·3 : 1	3,041	1,300	2·3 : 1
	4,178	1,753	2·3 : 1	11,312	3,898	2·9 : 1
	..	..	..	22,273	7,978	2·8 : 1
Total	**9,233**	**3,581**	**2·5 : 1**	**44,331**	**15,729**	**2·8 : 1**

386. *Cost of production of broodlac (artificial infection).*—The rates worked out below are for freshly cut brood lac and mature 'Ari' lac which contains the female lac insects with their undelivered brood :—

Cost of production of brood lac (artificial infection).

Crop period.	Trees infected.	Brood lac harvested.	Cost of pruning.*		Cost of infection.		Cost of Collection.		Total cost.		Average per lb.		
		LBS.	RS.	A.	RS.	A.	RS.	A.	RS.	A.	RS.	A.	P
December 1931—June 1932	2	170	2	0	1	12	4	2	7	14	0	0	9
June—December 1932	6	657	6	0	7	2	8	2	21	4	0	0	6
December 1932—June 1933 ..	12	2,026	12	0	9	6	9	12	31	2	0	0	3
	20	**2,853**	**20**	**0**	**18**	**4**	**22**	**0**	**60**	**4**	**0**	**0**	**4**
January—June 1932	6	367	6	0	6	12	2	13	15	9	0	0	8
June—December 1932	24	1,959	24	0	14	10	19	8	58	2	0	0	6
December 1932—June 1933 ..	34	1,509	34	0	26	9	29	8	90	1	0	0	11
June—December 1933	10	1,220	10	0	9	14	5	11	25	9	0	0	5
December 1933—May 1934 ..	15	4,178	15	0	15	0	15	0	45	0	0	0	2
	89	**9,233**	**89**	**0**	**72**	**13**	**72**	**8**	**234**	**5**	**0**	**0**	**5**

* *Note.*—The average cost of pruning a tree is taken as one rupee.

The cost of production of brood lac has become considerably reduced in the last crop.

387. *Cost of conversion of seed lac from brood lac at Cumbum—All crops.*—The cost of conversion per maund (82 lb.) of stick lac worked out below includes also the cost of its transport from Vannathiparai, where it was cut, to Cumbum where it was ground, washed and cleaned. The rates are calculated from the actual expenditure incurred on all crops.

Cost of conversion of seed-lac from brood-lac—All crops.

Stick lac in lb.	Washed lac in lb.	Cost of conversion.			Rate per maund (82 lb.) of stick lac.			Rate per maund (82 lb.) of seed lac.			Rate per pound of Stick lac.	Rate per pound of Seed lac.	
		RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	PIES.	AS.	P.
538	189	16	7	0	2	8	1	7	2	1	5·9	1	4·7
2,825	1,134	109	8	6	3	2	10	7	14	9	7·4	1	6·6
4,342	1,230	79	4	0	1	7	11	5	4	6	3·5	1	0·4
3,041	1,300	51	12	0	1	6	3	3	4	3	3·3	0	7·7
11,312	3,898	257	4	0	1	13	10	5	6	7	4·4	1	0·7
21,841	7,978	610	7	9	2	4	8	6	4	5	5·4	1	2·7

388. *Cost of production (at Cumbum) of seed-lac—Artificial infection.*—The total cost of production of seed-lac at Cumbum for all artificial crops is exhibited in the sub-joined statement :—

Cost of production (at Cumbum) of seed-lac—Artificial infection.

Crop period.	Brood lac harvested in lb.	Seed lac obtained in lb.	Cost of production of brood lac.	Cost of washing, etc.	Total cost.	Average cost of production of seed lac per lb.
			RS. A.	RS. A.	RS. A.	RS. A. P.
December 1931—June 1932 ..	170	57	7 14	7 8	15 6	0 4 4
June—December 1932 ..	657	297	21 4	24 12	46 0	0 2 6
December 1932—June 1933 ..	2,026	574	31 2	39 7	70 9	0 1 11
	2,853	**928**	**60 4**	**71 11**	**131 15**	**0 2 3**
January—June 1932	367	131	15 9	8 15	24 8	0 3 0
June—December 1932 ..	1,959	748	58 2	78 0	136 2	0 2 11
December 1932—June 1933 ..	1,509	429	90 1	29 6	119 7	0 4 5
June—December 1933 ..	1,220	520	25 9	23 14	49 7	0 1 6
December 1933—May 1934 ..	4,178	1,753	45 0	133 0	178 0	0 1 7
	9,233	**3,581**	**234 5**	**273 3**	**507 8**	**0 2 3**

It will be seen from the above that the actual cost of production of washed lac has gone down considerably, from 4 annas 4 pies to 1 anna 6 pies per pound. The average for all the crops taken together works out to 2 annas 3 pies per pound, i.e., Rs. 11–8–6 per maund (82 lb.). At the minimum rate of one anna 6 pies per pound the production cost comes to Rs. 7–11–0 per maund, which is the lowest on record for Madras Presidency. These rates represent the net cost of production and are exclusive of all overhead charges.

389. *Cost of production at Cumbum of seed-lac—All crops.*—The foregoing results are applicable only to crops raised by artificial infection as they have been deduced from data collected for such crops. But there were also crop yields from natural and other artificial crops which had been gathered and sold along with the artificially grown ones. These yields have not been taken into account in the financial calculations made for the artificial crops.

In order to have a satisfactory idea of the total income obtained up-to-date from lac cultivation at Vannathiparai it is essential to work out the financial result based on all the crops, natural as well as artificial, harvested till June 1934. This is possible as an accurate account of all items of expenditure on, and income from, lac operations has been maintained since the start of lac operations.

It seems also necessary to put on record all the figures which are now available as it is likely that crops from naturally infected trees might recur in future.

But it should be distinctly understood that these calculations are made only for judging the financial result of the whole operation up to June 1934, and they cannot be applied to regular crops raised on systematic methods.

Cost of production of seed-lac—All crops, Natural and Artificial.

Crop period.	Brood lac harvested in lb.	Washed lac in lb.	Cost of pruning.	Cost of production of seed lac.	Total cost.	Average cost of production of seed lac per lb.
			RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
January—June 1932 ..	538	189	8 0 0	* 99 9 0	107 9 0	0 9 1
June—December 1932 ..	2,825	1,134	42 0 0	194 13 3	236 13 3	0 3 4
December 1932—June 1933 ..	4,342	1,230	54 0 0	185 12 0	239 12 0	0 3 1
June—December 1933 ..	4,041	1,300	10 0 0	89 9 0	99 9 0	0 1 3
December 1933—June 1934 ..	11,560	3,898	15 0 0	373 14 0	388 14 0	0 1 7
June—November 1934 ..	22,273	7,978	66 0 0	832 9 9	898 9 9	0 1 10
Total ..	**45,579**	**15,729**	**195 0 0**	**1,776 3 0**	**1,971 3 0**	**0 2 0**

* *Note.*—Includes Rs. 49–9–0 the cost of brood lac obtained from Bihar.

The average cast of production at Cumbum of a maund (82 lb.) of seed-lac at 2 annas per pound wgrks out to Rs. 10–4–0. This is lower than the average cost of Rs. 11–8–6 per maund for the artificial crops. At the minimum rate of 1 anna 3 pies per pound. the cost of production comes only to Rs. 6–6–6 which is much lower than the minimum rate of Rs. 7–11–0 per maund for the artficial crops.

390. *Cost of packing, transport, etc., incurred in sending seed-lac.*—From the consignments of seed lac sent to Madras and Calcutta the following rates for packing, transport, weighing and loading of bags of seed-lac into wagons are calculated :—

Packing.—To withstand wear and tear in transport over long distances and transhipments *en route* seed-lac is usually packed in double gunnies. A new gunny can hold 123 lbs. (1½ maunds) of seed lac and costs about 3 annas. The average rate for packing material etc., will therefore ordinarily be about 4 annas per maund.

Transport.—Cost of transport from the Cumbum depot to Theni Railway Station, 25 miles, has been 8 annas per bag which comes to 5 annas 4 pies per maund. Considering that large consignments would go hereafter it could be reduced considerably.

Loading, etc.—Weighing and loading charges at 1 anna per bag were 8 pies per maund. This is also capable of reduction for large consignments.

Railway freight.—The goods rate per maund from Theni to Madras (Egmore) and to Calcutta (Shalimar) were Re. 0–13–4 and Rs. 3–2–0, respectively.

The total expenditure involved in packing, transport and booking 'prepaid' one maund of seed-lac from Cumbum to Madras was Rs. 1–9–0 (3·6 pies per lb.) and to Calcutta Rs. 3–13–8 (9 pies per lb.). As supplies to the Madras Penitentiary were arranged F.O.R. Madras no extra expenditure was incurred at the Madras end. But in the case of consignments sent for sale to Calcutta an additional expenditure of from Rs. 3–1–0 to Rs. 4–2–0 per maund was incurred, consisting of (1) weighing and coolie charges at 5 annas, (2) brokerage at Re. 1 and (3) testing fee and allowances for excess impurities at Rs. 1–12–0 to Rs. 2–13–0.

391. *Financial result of artificial crops on pruned trees.*—The total quantity of seed-lac produced by all the 109 pruned trees utilized for cropping was 4,509 pounds. (Vide para 388.) It was completely disposed of during 1934. The financial result of the operation is shown below :—

Revenue.

	RS.	A.	P.
By sale of 2,288 lb. of seed-lac at Rs. 25 per maund F.O.R., Madras.	695	6	10
By sale in Calcutta of 1,646 lb. at Rs. 40 per maund ..	800	0	0
By sale in Calcutta of 411 lb. at Rs. 41 per maund ..	205	0	0
82 lb. to the Director, Indian Lac Research Institute ..	29	12	0
82 lb. to the Standard Furniture Co., Limited	25	0	0
Total ..	**1,755**	**2**	**10**

Expenditure.

Cost of production of 4,509 lb. of seed-lac at Cumbum ..	639	7	0
Cost of packing, transport and Railway freight on 2,288 lb. sent to Madras at Rs. 1–9–0 per maund.	43	7	5
Cost of packing, transport and Railway freight on 2,057 lb. sent to Calcutta at Rs. 3–13–8 per maund.	96	5	8
Cost of transport, weighing, analysis, rebate and commission at Calcutta, 1,646 lb. at Rs. 3–1–0 per maund.	61	4	0
And 411 lb. at Rs. 4–3–0 per maund	20	15	0
Total ..	**861**	**7**	**1**
Net profit on 4,509 lb. or 109 trees	893	11	9
Net profit on 1 maund of 82 lb.	16	4	9
Net profit per tree	8	3	2

392. *Financial result of all crops.*—7,781 pounds of seed-lac were produced by all the crops, natural and artificial, till the end of June 1934. The financial result of lac operations since their commencement in January 1932 to the end of June 1934 is given below :—

Revenue.

By sale of 4,164 lb. of seed-lac at Rs. 25 per maund F.O.R. Madras.	1,268	4	0
Towards the supply of 82 lb. to the Director, Indian Lac Research Institute, Nankum, Ranchi.	129	12	0
By sale of 82 lb. to the Standard Furniture Co., Ltd., Kallai.	25	0	0

Revenue—cont.

	RS.	A.	P.
By sale of seed-lac in Calcutta, 1,646 lb. at Rs. 40 per maund.	800	0	0
823 lb. at Rs. 41 per maund	410	0	0
984 lb. at Rs. 41 per maund	492	0	0
Total ..	3,125	0	0

Expenditure.

	RS.	A.	P.
Cost of production of 7,781 lb. of seed-lac at Cumbum ..	1,072	9	3
Cost of packing, transport and railway freight on 4,164 lb. to Madras at Rs. 1–9–0 per maund.	79	1	3
Cost of packing, transport and Railway freight on 3,453 lb. sent to Calcutta at Rs. 3–13–8 per maund.	161	14	0
Cost of transport, weighing, analysis, rebate and commission at Calcutta, on 1,646 lb. at Rs. 3–1–0 per maund.	61	4	0
823 lb. at Rs. 4–3–0 per maund	41	14	0
984 lb. at Rs. 7–9–8 per maund	91	4	0
Total ..	1,507	14	6
Net profit on 7,781 lb.	1,617	1	6
Net profit on 1 maund of 82 lb.	17	0	0

PART II.

Future Management discussed and Prescribed.

CHAPTER I.—BASIS OF PROPOSALS.

SECTION 1.—GENERAL OBJECTS OF MANAGEMENT.

393. *Areas suitable for fuel supply.*—The main object of management in areas suitable for fuel supply to the City of Madura and to smaller towns is to provide for the attainment of the highest possible sustained annual net outturn per acre of forest, in perpetuity, *without deterioration.*

Other areas are to be managed so as to meet the legitimate demands for firewood from the adjoining villages, without deterioration of the forests, so that illicit removals may be minimized.

The fire protective belts of Australian wattles proposed to be grown round the sholas of the Upper Palnis will ultimately supply fuel to the villagers of the Upper Palnis.

394. *Timber forests.*—The timber forests will be primarily managed so as to supply the legitimate demand for timber and bamboos by the neighbouring population, in order to reduce illicit removals, and at the same time to provide for improving and augmenting the present supply by the formation of plantations and by other methods of regeneration. Attempts will also be made to introduce valuable but little known species of timber to the local market, and to study the growth of plantation teak under irrigated conditions. At the same time, revenue will be realized by the collection of minor forest produce without prejudice to the main object of management.

395. *Evergreen forests* (*rain forests and sub-tropical evergreens*).—In the evergreen forests the primary object of management will be to protect them from fire and other injuries so as to preserve their evergreen character in order that they may continue to conserve the water-supply of the various streams that irrigate the country below. At the same time in suitable sholas (rain forests) planting of cardamoms will be permitted, under careful control, so as to enable them to yield a handsome sustained annual rental not only without prejudice to the realization of the main object of preservation of type, but with a view to assist in it.

396. *Sandalwood.*—Sandalwood trees will be protected and tended so that they may grow up to sizes which will yield heartwood fit for sale. Any dead or dying sandalwood will be extracted if it contains saleable heartwood. The introduction of sandalwood into areas suitable for its growth will be prescribed so as to augment the future revenue of the division.

397. *Areas suitable for the cultivation of lac.*—The cultivation of lac on a commercial scale in areas that have proved eminently suitable for it will be prescribed on scientific lines. The maximum production of lac that the areas are capable of producing on a sustained basis will be aimed at and this will be worked up to in the shortest possible period. At the same time, attempts will be made to stock the areas more fully with young lac hosts so as to increase the yield from them and to provide for the replacement of hosts which may dry up and die.

398. Areas not suitable for any of the purposes mentioned above will be protected so as to conserve the water supply and to maintain the climatic conditions of the country : the extraction of bamboos and the collection of minor forest produce from such areas will be a legitimate source of revenue which is not likely to be prejudicial to this object.

SECTION 2.—METHODS OF TREATMENT TO BE ADOPTED.

399. *Areas suitable for fuel supply.*—The exploitation of areas suitable for the supply of fuel will be prescribed under the " Simple coppice " system, since that system produces the maximum quantity of the required produce in a reasonable period of time. Felling series will be so constituted as to distribute the centres of exploitation suitably and so that annual coupes of a reasonable size may be formed, under a rotation which will ensure sustained yields for ever. Special felling series will be constituted to supply the legitimate needs of neighbouring villages and thus minimize illicit removals. Suitable methods of artificial regeneretion will be prescribed so as to supplement natural regeneration and to arrest the deterioration of the growing stock, with a view to improve the future yield.

400. *Timber forests.*—The timber forests of the Cumbum Valley will be worked partly under the " Selection system " and partly under the " Clear-felling system " in order to supply, at least in part, the legitimate demands of the inhabitants of the valley and thus minimize the extensive illicit removals of timber prevailing there. The re-stocking of exploited areas by means of " Gap regeneration " and by plantations of useful timber species will be prescribed. Overmature trees of *Artocarpus hirsuta* in the Natham range (Karandamalais) will be exploited and replaced by gap regeneration of teak and *Artocarpus hirsuta* in the gaps formed. Brake poles will continue to be provided for cartmen going down the Kodaikanal Ghaut road.

401. The extraction of bamboos will be regulated on a rotation of three years, the annual coupes being suitably devised, so as to ensure sustained yields in perpetuity.

402. *Evergreen forests.*—The cultivation of cardamoms in suitable areas in the rain forest type will be encouraged under strict control. Attempts will be made to grow a fire resistant belt of wattles (*Acacia decurrens, Acacia dealbata* and *Acacia melanoxylon*) round the sub-tropical evergreens of the Upper Palni plateau.

403. *Sandalwood.*—Existing sandalwood trees will be protected against fire and other injuries, and tended where necessary, dead and dying trees with saleable heartwood will be extracted and sandal propagation centres will be formed in suitable localities.

404. The Vannathiparai valley will be set apart for the production of ' Kusum ' lac on a commercial scale. The exeprimental production of lac on *Shorea talura* on the Karandamalais will be initiated.

405. Climatic forests not suitable for exploitation will be prescribed for protection, without prejudice to the collection of minor forest produce from them.

406. The exploitation of minor forest produce will be organized on economic lines and with due reference to the needs of forest labour.

407. The formation of live fire protection belts of Australian wattles will be prescribed round the sholas of the Upper Palnis and the Kodaikanal Pine plantations.

SECTION 3.—WORKING CIRCLES, THEIR AREA AND DISTRIBUTION, REASONS FOR THEIR FORMATION.

408. In order to realize the objects of management, and to enable correct methods of treatment to be applied, the following nine Working Circles have been constituted :—

Serial number and Working Circles.	Area in acres.	Distribution.
1 The Selection Working Circle	14,366	14,246 acres are in Cumbum range and 120 acres in Natham range.
2 The Clearfelling Working Circle	700	480 acres are in Surulipatti plateau, 120 acres in Vannathiparai and Suranganar valleys—all in Cumbum range ; 55·4 acres in Velancombai Reserve Forest of Palni range ; and 44 acres in Iruttar valley of the Kodaikanal range.
3 The Fuel Working Circle	1,67,157	In all six ranges.
4 The Brakepole Working Circle	700	Along motor ghaut road, Kodaikanal range.
5 The Bamboo Working Circle	1,10,454	In Cumbum, Kodaikanal, Palni and Natham ranges.
6 The Sandalwood Working Circle	16,000	In all ranges except Aiyalur.
7 The Minor Forest Produce Working Circle.	3,96,841	The whole division : area of unreserves not noted.
8 The Lac Working Circle	2,900	In the Vannathiparai Valley, Cumbum range.
9 The Protection Working Circle	1,21,427	In all ranges. Areas not included in any Working Circle except Minor Forest Produce Working Circle.

SECTION 4.—RECOMMENDATIONS OF THE ROYAL COMMISSION ON AGRICULTURE.

409. The following prescriptions will meet the recommendations of the agricultural commission, without prejudice to the silvicultural needs of the forests.

Recommendation 1.—" Grass cutting should be encouraged as an alternative to grazing."

Individuals will be permitted to remove fodder grass in headloads free of cost from all areas, including areas closed to grazing, whether temporarily or permanently.

Recommendation 2.—" The grazing of inferior cattle in the forests should be discouraged."

A suitable increase in grazing fees is the most equitable way of giving effect to this recommendation. Over the major part of the division, the forests are primarily fuel-producing areas. Though they are open to grazing, the forests do not contain sufficient grass to justify any increase in the existing scales of fees. In the Upper Palni plateau of the Kodaikanal range, however, the villagers enjoy the privilege of free grazing over extensive grass lands in the Ampthill Downs Reserve Forest. In addition to this unique privilege the fees charged for permits to graze in other areas over which this privilege does not extend are much below those prevalent in other parts of the division. It is therefore proposed to raise the fees in this locality to the level that prevails in the rest of the Madura district.

Recommendation 10.—" The initiation of new and the development of existing forest industries are matters of great importance to the agricultural population."

The scheme to grow lac on a commercial scale in the Vannathiparai valley will initiate a new forest industry of considerable value to the neighbouring villagers.

The large number of fuel coupes distributed over the division provide work for hundreds of villagers, in felling and transport.

The proposed Timber Working Circles in Cumbum range are intended primarily to provide legitimate work in lieu of the prevailing illicit removals.

Recommendation 15.—" All shifting cultivation should be brought under control with a view to the practice being stopped wherever it is productive of harmful results."

No shifting cultivation is being practised at present in the reserves of the division. It is proposed to introduce it under departmental control on an experimental scale, for the regeneration of fuel coupes.

SECTION 5.—PERIOD OF THE WORKING PLAN AND THE NECESSITY FOR INTERMEDIATE REVISION.

410. This Working Plan will be in force from 1936–37 to 1945–46, for a period of ten years. The Working Plan for the Lac Working Circle has been prepared only for five years, from 1935 to 1940, as the effect of continuous cropping on old kusum trees has yet to be ascertained.

411. " Rab " regeneration of fuel coupes is being prescribed in the Working Plan on a scale not attempted hitherto in these forests. " Kumri " regeneration of fuel areas is being introduced for the first time as an experimental measure.

Therefore, it will be necessary after five years to review the regeneration measures prescribed, and modify them suitably in the light of experience gained by that time.

At the same time, the desirability of extending the teak plantations in the Cumbum valley should be considered if the results obtained by the prescribed methods of keeping out wild elephants from them are satisfactory.

The Lac Working Plan will require revision in 1940.

412. The field work connected with the general revision of the plan should be commenced a year before the date fixed for its expiry, viz., early in 1945.

CHAPTER II.—WORKING PLAN FOR THE SELECTION WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

413. The " Selection " Working Circle consists of the exploitable deciduous forests of the Cumbum range not included in the Fuel Working Circle, and the several valleys of the Karandamalai and Alagar hills reserves of the Natham range in which narrow belts of semi-evergreen forests containing magnificient specimens of *Artocarpus hirsuta* and other species grow on either side of perennial streamlets. Such of the area in the Clearfelling

Working Circle in the Cumbum range as has not been clearfelled at any time for planting will remain in the Selection Working Circle until it has been clearfelled, when it will pass out of the latter Working Circle into the former. The area in the Lac Working Circle in the Vannathiparai valley is also included in the Selection Working Circle.

The total area of the Selection Working Circle is 14,366 acres.

Practically the whole of the Working Circle belongs to the deciduous type situated in the Cumbum range.

414. The timber forests of the Cumbum range fall conveniently into three main types —the Vannathiparai type, the Surulipatti type and the forests on the slopes above the upper limits of the Fuel Working Circle.

The Vannathiparai forests are of superior quality and belong to the plains sub-type described in paragraph 37 (i) of Chapter II of Part I. The forests above the upper limits of the Fuel Working Circle fall under the hill sub-type described in paragraph 37 (ii) of the same chapter, and the Surulipatti forests are a type intermediate between these two. A profusion of tall " elephant " grass results in almost annual fires on the Surulipatti plateau. What must have been a superior type of forest has degenerated, in consequence, into an open deciduous type overrun with grass except in the neighbourhood of perennial streams where a better quality is still evident.

On either side of perennial streams in the Karandamalai and Alagar Hills Reserves of the Natham range, narrow belts of semi-evergreen growth contain tall well-grown trees of *Artocarpus hirsuta, Bischofia javanica, Mangifera indica* and *Terminalia arjuna.*

SECTION 2.—DIVISION OF THE AREA.

415. The Working Circle divides itself naturally into the deciduous timber forests of the Cumbum range and the semi-evergreen belts of the Natham range.

The area of the Working Circle in the Cumbum range is 14,246 acres and that in the Natham range about 120 acres.

SECTION 3.—ANALYSIS AND VALUATION OF THE CROP.

416. All trees of *Artocarpus hirsuta* in the semi-evergreen valleys of the Karandamalai and the Alagar Hills Reserves of the Natham range, were enumerated down to a minimum girth of one foot at breast height. Similarly, all trees of *Bischofia javanica* and *Mangifera indica* were enumerated down to a minimum girth of 3 feet—Vide paragraph 380.

417. In the timber forests of the Cumbum range sample plots in the form of strips 5 chains wide were enumerated in the Vannathiparai and Suranganar valleys and on the Surulipatti plateau. Similar sample plots one chain wide were enumerated in the Kombai and Machakal timber areas. Valuable timber trees in the sample plots were enumerated specieswar, all others being classified as " miscellaneous." Trees down to a minimum breast height girth of 3 feet were measured in one foot girth classes and two quality classes were distinguished.

The percentage of the areas enumerated in the different localities has been recorded in paragraph 381 of Part I of this plan. The tabular statement below gives the total growing stock in the Gudalur and Cumbum Felling Series, based on the enumerations referred to above :—

Total growing stock over 3 feet girth at breast height—Cumbum range.

Species.	3′–4′.		4′–5′.		5′–6′.		6′–7′.		7′–8′.	
	First.	Second.	First.	Second.	First.	Second.	First.	Second.	First.	Second.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CUMBUM SERIES.										
Dalbergia latifolia	557	2,552	337	855	215	393	79	245	82	123
Pterocarpus marsupium	823	6,519	203	3,375	79	1,270	15	628	46	311
Tectona grandis	558	7,092	99	2,498	69	841	8	208	15	128
Albizzia odoratissima and *lebbek.*	761	2,570	351	1,717	256	732	147	227	58	166
Adina cordifolia	311	559	244	402	205	610	148	274	178	298
Stereospermum chelonoides ..	361	3,121	187	1,692	109	838	73	589	..	132
Grewia tiliæfolia	2,253	8,310	425	2,622	210	1,000	51	203	64	113
Shorea talura	360	2,864	99	899	77	260	15	189	8	24
Total ..	..	..	..	..	..	..	..	..	..	..
Miscellaneous	5,169	36,082	2,470	14,999	1,432	7,238	571	4,133	353	2,156

Total growing stock over 3 feet girth at breast height—Cumbum range—cont.

Species.	8′–9′. First. (12)	8′–9′. Second. (13)	9′–10′. First. (14)	9′–10′. Second. (15)	Over 10′. First. (16)	Over 10′. Second. (17)	Grand total. (18)	Over 6′ girth. First. (19)	Over 6′ girth. Second. (20)	Total of over 6′ girth. (21)
CUMBUM SERIES—*cont.*										
Dalbergia latifolia	27	..	..	24	..	..	5,489	188	392	580
Pterocarpus marsupium	15	24	15	..	8	33	13,364	99	996	1,095
Tectona grandis	..	95	15	113	8	66	11,813	46	610	656
Albizzia odoratissima and *lebbek*.	8	66	17	..	..	33	7,109	230	492	722
Adina cordifolia	93	71	147	95	132	24	3,791	698	762	1,460
Stereospermum chelonoides ..	27	..	..	57	..	..	7,186	100	778	878
Grewia tiliæfolia	..	..	..	..	..	..	15,231	115	316	431
Shorea talura	..	..	..	..	..	..	4,795	23	213	236
Total ..	..	..	..	..	..	..	..	**1,499**	**4,559**	**6,058**
Miscellaneous	219	1,433	154	679	305	2,042	79,435	1,602	10,443	12,045

Species. (1)	3′–4′. First. (2)	3′–4′. Second. (3)	4′–5′. First. (4)	4′–5′. Second. (5)	5′–6′. First. (6)	5′–6′. Second. (7)	6′–7′. First. (8)	6′–7′. Second. (9)	7′–8′. First. (10)	7′–8′. Second. (11)
GUDALUR SERIES.										
Dalbergia latifolia	1,152	3,403	650	1,556	502	659	319	278	183	101
Pterocarpus marsupium	11	3,894	34	1,405	11	534	..	123	34	123
Tectona grandis	114	7,660	46	3,468	23	1,976	..	212	..	89
Albizzia odoratissima	331	4,406	388	2,158	251	936	193	317	114	304
Adina cordifolia	548	985	479	646	513	608	319	266	297	216
Stereospermum chelonoides ..	879	2,234	593	806	456	1,370	262	719	217	520
Grewia tiliæfolia	1,433	7,249	1,040	4,179	913	1,787	399	76	251	127
Terminalia paniculata	..	887	..	444	..	266	..	89	..	89
Total ..	..	..	..	..	..	..	..	..	..	..
Miscellaneous	4,667	31,232	2,294	19,541	1,552	6,725	1,016	3,817	685	2,028

Species.	8′–9′. First. (12)	8′–9′. Second. (13)	9′–10′. First. (14)	9′–10′. Second. (15)	Over 10′. First. (16)	Over 10′. Second. (17)	Grand total. (18)	Over 6′ girth. First. (19)	Over 6′ girth. Second. (20)	Total of over 6′ girth. (21)
Dalbergia latifolia	23	51	23	76	..	51	9,027	548	557	1,105
Pterocarpus marsupium	..	..	..	..	..	..	6,169	34	246	280
Tectona grandis	..	89	..	300	..	..	13,977	..	690	690
Albizzia odoratissima	23	190	23	..	..	25	9,659	353	836	1,189
Adina cordifolia	148	114	345	25	..	25	5,534	1,109	646	1,755
Stereospermum chelonoides ..	68	51	46	..	23	152	8,388	616	1,442	2,058
Grewia tiliæfolia	39	202	..	..	..	..	17,690	684	405	1,089
Terminalia paniculata	..	89	..	89	..	266	2,219	..	622	622
Total ..	..	..	..	..	..	..	..	**3,344**	**5,444**	**8,788**
Miscellaneous	342	1,137	365	810	524	1,341	78,086	2,932	9,133	12,065

NOTE.—" Miscellaneous " includes *Anogeissus latifolia*.

' First,' ' Second ' denote quality classes.

These figures cannot be considered to be accurate on account of the considerable variations in stocking that prevail from place to place, the existence of extensive illicit fellings and the comparatively small proportion of the total area that was enumerated. But considering the primary object of management, and the fact that the growth is not sufficiently valuable to justify the complete enumeration which alone can give a closer degree of accuracy, the partial enumeration made was considered sufficient to fix the minimum exploitable girth and to allot annual coupes of approximately equal yield.

SECTION 4.—METHOD OF TREATMENT.

418. *Objects of management.*—The demand for timber in the villages of the Cumbum valley is keen. For want of legitimate means of meeting this demand the Kallars of the valley have long been in the habit of stealing timber from the reserves. The primary object of this Working Circle is to enable this demand to be met legitimately and as a result to furnish an honest means of livelihood to some of the Kallar population. An appreciable quantity of mature and overmature timber suitable for exploitation and sale is disclosed by the enumerations conducted by the Working Plans staff. The exploitation of this timber is silviculturally desirable and is the second object which the management has to secure. Both the objects can thus be attained by exploiting this mature and overmature timber in a suitable manner.

A number of overmature trees of *Artocarpus hirsuta* of large dimensions are deteriorating in the Karandamalai and Alagar Hills Reserves. It is desirable to exploit them.

419. *Silvicultural system.*—The silvicultural system will be "Selection felling" of trees of all saleable species over and above the minimum girth prescribed below. The replacement of the timber extracted in selection fellings will be secured partly by the artificial regeneration of gaps in suitable localities and partly by clear-felling and concentrated regeneration in areas suitable for planting with teak, under the Clearfelling Working Circle.

420. *Choice of species.*—All saleable species over the prescribed minimum girth will be felled and extracted. Teak, *Dalbergia latifolia, Pterocarpus marsupium, Albizzia lebbek, Albizzia, odoratissima, Adina cordifolia, Stereospermum chelonoides, Shorea talura, Grewia tiliaefoilia,* and *Terminalia paniculata* are the saleable species generally met with in the Cumbum range. *Artocarpus hirsuta* and *Mangifera indica* are the saleable species found in the Natham range.

Teak will be the primary species to be regenerated and *Dalbergia latifolia, Pterocarpus marsupium* and *Artocarpus hirsuta* will be introduced as secondary species.

421. *Felling Series.*—The semi-evergreen belts in the Natham range will form the "Natham Timber Series." Its area is approximately 120 acres.

The timber forests of the Cumbum range will be constituted into two felling series—the "Cumbum Timber Series," and the "Gudalur Timber Series"—with the main object of distributing the centres of work so that they may always be easily accessible to labour. This division will also help to secure smaller units for supervision and control, which can consequently be more effectively achieved. The total area of the Cumbum Series is 6,628 acres and that of the Gudalur Series 7,618 acres.

422. *Exploitable size.*—For the Cumbum and Gudalur Series the minimum exploitable girth is fixed arbitrarily at 6 feet over bark at breast height, for all species.

The average number of trees above this minimum girth varies from three to one-tenth per acre, as disclosed by enumeration statistics. The creation of two to three gaps per acre is not likely to prejudice the preservation of the factors of the locality over these forests.

For the Natham Series, a breast height girth of eight feet over bark is fixed arbitrarily as the minimum exploitable girth. Since *Artocarpus hirsuta* is utilized mainly as planks, a higher exploitable girth than 6 feet has been prescribed for it.

It is not desirable to fell any healthy vigorous trees of *Mangifera indica* as such trees yield mangoes suitable for pickling which are valued locally. Only such trees as exhibit signs of decay will be felled.

423. *Rotation.*—There are no data available which will serve to fix the rotation. Under the system of working proposed the fixing of the period of rotation is merely of academic interest.

424. *Felling cycle.*—It has already been stated that illicit fellings are rife in the timber forests of the Cumbum Valley. The object of working the timber forests in this valley is largely in order to prevent theft and therefore it is necessary to have as short a felling cycle as possible, consistent with the requirements of sound silviculture, so that the saleable, trees may be departmentally harvested before they are stolen. The principle of sustained equal annual yield has to be subordinated to the more urgent one of the necessity for breaking the habit of theft which is so strong among the Kallars who live in this Valley. The fact that the local population find it difficult to get what they require in the way of small timber, also has its effect on the extent of the illicit removals. The break in this habit which the fellings prescribed in this Working Circle will effect, is expected to enable the department to protect these forests better in future, even when the outturn falls in the next felling cycle. For these reasons a felling cycle of ten years is prescribed for the Cumbum and Gudalur Timber Series.

The area covered by the Natham Timber Series is small, where the *Artocarpus* trees are distributed along the banks of perennial streams in various localities. The formation of annual coupes under these conditions is impracticable nor is it necessary. The whole area will therefore be exploited every year: the felling cycle will be annual.

425. *The yield.*—(1) The yield will be regulated by area for the Cumbum and Gudalur Series. The probable number of trees of all important species (see list below) above the minimum exploitable girth of 6 feet that are likely to be obtained from each of the annual coupes have been worked out from statistics collected for this plan. Variations in quality and stocking have been allowed for, as far as practicable, by selecting sample plots for enumeration in localities of different qualities. However, considering the variations in growth from place to place, the comparatively poor quality of a considerable part of the

area, the varying intensity of illicit fellings and the small proportion of the total area enu merated, no great accuracy can be claimed for the estimates of probable yield worked out herein, nor does the main object of management require a closer degree of accuracy. The enumerations give an indication of the distribution of girth classes of the valuable species within the Working Circle and serve to assure us that the classes below the minimum exploitable girth are sufficiently well represented to preclude the apprehension of a serious reduction in yield in the next and succeeding felling cycles. The probable average annual outturn of teak, *Dalbergia latifolia, Pterocarpus marsupium, Albizzia sp., Adina cordifolia, Stereospermum chelonoides, Grewia tiliæfolia* and *Terminalia paniculata* from the Cumbum series has been estimated at 606 trees and from the Gudalur series at 879 trees. To these must be added a certain number of saleable trees included under " Miscellaneous " which cannot be estimated with any pretence to accuracy, but may be roughly put at a hundred trees for each series per year.

(2) In the Natham Series, all trees above the minimum exploitable girth of 8 feet will not be felled in the first year. The local demand for *Artocarpus hirsuta* is small and requires to be stimulated. One tree was felled and converted by the writer in 1934 and half the material still remains unsold (October 1935). Under these circumstances, the exploitable trees will be harvested gradually over a period of ten years.

The total number of *Artocarpus hirsuta* trees in the Natham Series above the minimum exploitable girth of eight feet is 94. The average rate of girth increment of this species up to 53 years of age, in the Kannoth range of the Wynad Division, is 1·17″ per annum. It will therefore be safe to assume that six trees will grow into the class of exploitable trees (over 8 feet girth at breast height) from the next lower girth class in the course of the ensuing ten years. Thus the total number of exploitable trees at the end of the next ten years is likely to be a hundred and this number will therefore be felled in the course of the next ten years.

Since the local demand for this timber is not keen and has to be stimulated the annual yield will be fixed at a maximum of ten trees : a smaller number may be felled in the early stages, at the discretion of the District Forest Officer, provided that the deficiency is made up in the succeeding years.

426. *Coupes.*—The coupes in the Gudalur and Cumbum Series have been demarcated on the Working Plan maps. They are not of equal extent but are approximately equiproductive with reference to the total number of exploitable tress of the following species :— Teak, *Dalbergia latifolia, Pterocarpus marsupium, Albizzia sp., Stereospermum chelonoides, Adina cordifolia, Grewia tiliæfolia, Shorea talura* and *Terminalia paniculata.* Other miscellaneous species, the market value of which are problematic, have not been considered in the allotment of coupes of equiproductive capacity. The coupes vary in extent from 2,450 acres to 400 acres. The whole of the Natham Series is the annual coupe for that series.

The subjoined statement exhibits the annual coupes and the probable yield from the Cumbum and Gudalur series :—

Coupes.	Cumbum series.		Gudalur series.	
	Area in acres.	Probable yield : number of trees.	Area in acres.	Probable yield : number of trees.
(1)	(2)	(3)	(4)	(5)
I	600	700	420	750
II	570	700	600	960
III	700	549	400	1,050
IV	920	500	600	950
V	800	550	410	950
VI	800	650	480	800
VII	500	550	540	950
VIII	700	500	850	900
IX	400	750	812	750

SECTION 5.—EXPLOITATION.

Gudalur and Cumbum Series.

427. *Agency.*—Fellings through contract agency have resulted in the recent past in extensive illicit fellings under cover of the contract which should therefore be avoided in future. Also the sale of marked trees to contractors cannot ensure the employment of Kallar labour, which is necessary to minimise theft. The trees in the Gudalur and Cumbum Timber Series should therefore be exploited departmentally in order that the primary object of management (reduction of theft by Kallars) may be realised as fully as possible.

For the same reason every effort should be made to employ only Kallars for all works connected with felling, coversion and extraction. Labour outside the Kallar community should not be employed for the purposes mentioned above except in consultation with the Conservator. The Kallars are experts at felling and conversion and can even use a saw with some dexterity : no difficulty is therefore anticipated in securing the kind and amount of labour required.

428. *Marking.*—The trees for extraction should be marked systematically and progressively, commencing from one end of the annual coupe. The following marking rules are prescribed for guidance :—

(1) All trees, sufficiently sound to be saleable, of the valuable species, of a breast height girth of six feet and over measured over bark, will be marked for felling, provided that no *Schelichera trijuga* may be marked inside the Vannathiparai Valley.

(2) The trees shall be numbered in tar on a blaze at the base of each tree and also on the bole at about 4 feet from ground level. The bark and sapwood must be removed before writing and the numbers should be clear and legible.

(3) The trees should be numbered serially, irrespective of the species marked. The adoption of a single series of numbers each year for the two annual coupes of the Working Circle in the Cumbum range will help to prevent confusion.

(4) The girth of the marked tree will be taped at breast height (4′ 6″ from the ground) over bark and the total length of saleable log in the tree will be estimated by eye and entered in Form 3, along with the name of the species to which it belongs.

(5) The marking shall be done by an officer not below the rank of a forester. At least 20 per cent of the marking shall be checked and certified to by the Range Officer and as much as possible by the District Forest Officer or his gazetted assistant.

(6) The marking shall be completed by the end of December preceding the year of felling (April to March) in order to afford sufficient time for the preparation of estimates and for checking.

(7) All climbers found attached to a marked tree shall be cut at the time of marking.

(8) No two marked trees shall be nearer than 30 feet from each other unless they will together create one gap when felled.

429. *Felling, Conversion and Extraction.*—Felling should commence at one end of the coupe and progress systematically towards the other end. Trees should be felled as close to the ground as practicable and in such a way as to cause minimum damage to themselves and to valuable standing trees or poles. Any unmarked tree unavoidably broken in the course of felling should be converted if saleable. All damaged seedlings should be cut back neatly at ground level. The officer in charge of fellings (who should not be below the rank of a forester) will see that the felled tree is converted into logs, to the best advantage. He will then mark the stump with his property hammer, number and measure the logs and bring them to stock in the manner required by the Forest Code.

The logs will then be squared, or converted to scantlings or other saleable material, depending upon the species, the nature of the log and the facilities of transport from stump-site to the sale depot.

Logs may be transported by carts from the major part of the Vannathiparai Valley. Timber from the Surulipatti plateau may largely be carted as logs after the Surulitholuvu road has been put into order, or the logs may be dragged down the Pandarathorai and Pachakumachi dragpaths. Logs within reach of the Kumli ghat road may be carted down that road. Logs from other localities will have to be converted into *saleable scantlings* of sizes *suitable for manhandling* or into spokes and felloes and other saleable material.

Forms 3, 4 and 5 will be maintained, and stock books and depots will be checked and inspected as prescribed in the Forest Code.

All felling and extraction should be completed before the 31st of December.

Natham Series.

430. *Agency and Marking.*—The exploitable trees (over 8 feet in girth at breast height) will be marked anywhere in the series.

Planks converted from a live tree in this locality in 1934, after the logs were seasoned under shade for over 6 months, cracked and split badly in spite of the greatest care in stacking under shade. It is therefore prescribed that, as an experimental measure, the trees will be marked a year ahead of fellings and *girdled*, so that they may be dead and partly seasoned at the time of felling.

The trees will be sold standing to contractors. If no purchasers be forthcoming or if reasonable prices are not offered, the work should be taken up departmentally.

The marking rules prescribed in paragraph 428 above may be followed generally: no elaborate instructions for the marking of ten trees every year are called for.

431. *Felling, conversion and extraction.*—The rules laid down for the Cumbum and Gudalur Series may be followed generally. If the trees are sold standing the purchaser will do the conversion and extraction as he deems fit. The work should be completed before the 31st of March.

SECTION 6.—REGENERATION.

432. The artificial regeneration of gaps in parts of the Cumbum range cannot be recommended as circumstances peculiar to their situation make successful fire protection impracticable within the limits of reasonable expenditure. To attempt the regeneration of gaps in localities which cannot be made reasonably immune from fire is a waste of money and effort. The artificial regeneration of gaps in the Cumbum and Gudalur Series will, therefore, be confined to the Surulipatti plateau and the plains portion of the Vannathiparai Valley. The danger of fire in the latter locality is remote as it supports no high grass, and fires spreading into it from other places can be kept out with comparative ease.

It is proposed to close the Surulipatti plateau to grazing and to place it under rigid fire protection, with a view to check the damage that annual fires have been inflicting on tree growth which must once have been distinctly of a better quality. Regeneration in gaps in these two localities may therefore be possible without much fear of its being destroyed by fire.

The following areas may ultimately be found suitable for gap regeneration :—

Cumbum Series, Total area, 6,434 acres.	2,700 acres in the Surulipatti plateau and 1,900 acres in the Vannathiparai Valley may be found suitable.
Gudalur Series, Total area, 7,324 acres.	1,400 acres in the Poriparai Valley of the main Vannathiparai Valley may be found suitable.

Natham Series, Total area, 120 acres.—All gaps may be found suitable.

433. The method of gap regeneration has however still to prove its value. Measures are therefore prescribed only on an experimental scale.

It is prescribed that 25 gaps in each of the Cumbum and Gudalur Series and all gaps in the Natham Series (about 10 per year) will be regenerated every year for the first five years, in the manner described below. At the close of this period the District Forest Officer will report upon the results achieved and the Conservator of the Circle will decide whether to restrict or expand activities in this direction.

434. *Species.*—Teak shall be the only species to be introduced in gaps on the Surulipatti plateau. *Dalbergia latifolia* and *Pterocarpus marsupium* will be introduced in the Vannathiparai Valley ; teak is not proposed for this valley as it is nearly always destroyed by wild elephants.

Teak, *Dalbergia latifolia* and *Artocarpus hirsuta* will be introduced in gaps in the Natham Series.

435. *Selection of gaps.*—Gaps for regeneration may be selected in convenient places in a coupe. Their position will be located in a plan drawn to a scale of not less than 8″=1 mile. The minimum size of a gap suitable for regeneration is fixed at 400 square yards (about 1 chain × 1 chain) so that the selected gaps should be enlarged at least to this minimum, if necessary, by cutting out or girdling valueless species. Gaps with sufficient natural regeneration in them may not be selected for artificial regeneration. The selection of gaps should be done by the Range Officer, who should complete it by the end of December.

436. *Burning.*—Branchwood and other inflammable material will be cut up and piled in the centre of the gaps to be regenerated. The piles should be low and flat so as to cover as large an area as possible and so as not *to burn too intensely*. An intense burn adversely affects the height growth in the first year. Piles 2–3 feet high should be satisfactory. They should be burnt as early as possible in order to reduce the risk of fire spreading into the neighbouring forests—the middle of January will probably be found right. Great care should be exercised to prevent any fire from escaping into the surrounding forest, by employing a sufficient number of coolies to control the burn.

437. *Staking.*—The ash should be spread over the gap and stakes 2½′—3′ high should be put in at an approximate espacement of three feet, as judged by the eye. This work should be completed by the end of March.

438. *Planting.*—Teak stumps 0·4″ to 0·8″ in diameter at the collum will be planted at each stake by the middle of April in the gaps selected on the Surulipatti plateau. Stumps of *Dalbergia latifolia* (0·2″ to 0·5″ in diameter) and *Pterocarpus marsupium* (0·4″ to 0·8″ in diameter) will be planted in equal proportions, by the middle of April, at the stakes in the gaps selected in the Vannathiparai Valley. The species may be mixed by planting one species at every alternate stake.

Stumps of teak (0·4″ to 0·8″ in diameter) *Dalbergia latifolia* (0·2″ to 0·5″ in diameter) and *Artocarpus hirsuta* (one and two-year old) will be planted in all the gaps in the Natham Series. The teak will be planted in the centre of the gap and the other two species round the periphery. About 50 per cent of the stakes in each gap should be planted with teak and the balance divided more or less equally between the other two species.

In addition to stumps, seeds of *Artocarpus hirsuta*, gathered fresh, will be dibbled at every stake where a stump of that species has been planted, as soon as ripe seeds are available. This precaution is necessary for this species in view of some doubts about the superiority of stumps to dibbling of seeds of *Artocarpus hirsuta*.

Approximately 100 stumps will be required for a gap of average size. The required number should be raised with the stumps for the Clearfelling Working Circle. The preparation of the stumps and the method of planting them are described in paragraphs 478 and 484 of Chapter III of Part II of this Working Plan.

SECTION 7.—SUBSIDIARY REGULATIONS.

439. *Casualties.*—Casualties will be replaced by stumps during weedings up to the end of November of the year of planting.

440. *Weeding and tending.*—If the burning is satisfactory very little weeding ought to be necessary but this ideal is rarely realized. It is difficult to lay down definitely what may be required but the aim should be to get a good stocking of well grown seedlings at the end of the first year in order that second year tending may be obviated as far as possible. All lantana and thorny climbers in and round the gap should in general be *uprooted*.

Elephant grass among the seedlings should also be uprooted or scraped off with a mamti.

Weeding in the first year is estimated to cost 4 annas to 8 annas per gap.

The total cost of regenerating a gap is estimated not to exceed one rupee.

Some weeding and climber cutting will be required in the second year also.

The Provincial Silviculturist should be consulted periodically in regard to the latest practice in connection with gap regeneration.

SECTION 8.—MISCELLANEOUS PRESCRIPTIONS.

441. *Grazing and fire protection.*—The forests of the Surulipatti plateau have long been subject to illicit fellings and annual fires and have deteriorated considerably in quality in consequence. Though the plateau is being specially protected against fire every year by means of a system of exterior fire lines, fires have swept across large portions of it almost every year. Many of the fires are due to collectors of minor forest produce and graziers, but some have been caused with a view to obliterate traces of illicit fellings.

In order to save these forests from further deterioration it is recommended that steps should be taken to close the Surulipatti plateau entirely to all grazing. This matter has been discussed in more detail in Chapter XI of this plan in paragraph 830.

The system of exterior firelines will continue to be maintained, with the modifications prescribed in Chapter XI, paragraph 798. The coupes in the Clearfelling Working Circle will be protected by separate fire lines as prescribed under that Working Circle.

The departmental collection of minor forest produce through the Paliyans of the Vannathiparai settlement has been prescribed in Chapter VIII in paragraph 665.

442. *Demarcation of coupes.*—The boundaries of coupes generally follow natural features. Wooden signboards, 18 inches by 9 inches, engraved with the number of the coupe and the year of felling should be nailed on to trees along the boundary in prominent places and along paths.

SECTION 9.—CONTROL.

443. The following control records will be maintained :—

(1) The Control Book,
(2) The Record of Works, and
(3) The Regeneration Ledger.

Sample forms are given in Appendix VI (*b*) (*j*) and (*l*). Standardized forms have been used.

Tabular statement of fellings in the Selection Working Circle.

Year.	Name of felling series.						
	Cumbum series.			Gudalur series.			Natham series.
	Coupe. number.	Area in acres.	Yield in number of trees.	Coupe number.	Area in acres.	Yield in number of trees.	Yield in number of trees.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1937–38 ..	I ..	600	700	I ..	420	750	10
1938–39 ..	II ..	570	700	II ..	600	960	10
1939–40 ..	III ..	700	549	III ..	400	1,050	10
1940–41 ..	IV ..	920	500	IV ..	600	950	10
1941–42 ..	V ..	800	550	V ..	410	950	10
1942–43 ..	VI ..	800	650	VI ..	480	800	10
1943–44 ..	VII ..	500	550	VII ..	540	950	10
1944–45 ..	VIII ..	700	500	VIII ..	850	900	10
1945–46 ..	IX ..	400	750	IX ..	812	750	10
1946–47 ..	X ..	..	..	X ..	..	..	10

REMARKS.—In the Natham range the trees will be selected from the whole felling series.

CHAPTER III.—WORKING PLAN FOR THE CLEARFELLING WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE WORKING CIRCLE AND CHARACTER OF THE VEGETATION.

444. The Clearfelling Working Circle includes areas suitable for clearfelling and planting with teak in the Surulipatti plateau and the Vairavanar valley of the Cumbum range, the Iruttar valley of the Kodaikanal range, and the Velancombai reserve of the Palni range. The existing teak plantations at Vannathiparai and Velancombai have also been included in this Working Circle.

The total area of the Working Circle is about 700 acres distributed as shown below :—

Locality.	Area.	Remarks.
(1)	(2)	(3)
	ACS.	
1 The Surulipatti plateau	480	Computed from (130 acres II stockmaps Class). prepared by eye estimate.
2 The Vairavanar valley (below Kumli ghat road).	50	
3 The Iruttar valley	40	
4 The Velancombai reserve	40	
5 Teak plantations at Vannathiparai	70	
6 Teak plantations at Velancombai	15·4	
Total ..	695·4	

445. On the Surulipatti plateau the areas included in the Working Circle support a deciduous crop of trees of teak, *Dalbergia latifolia, Pterocarpus marsupium, Adina cordifolia, Albizzia lebbek,* and *Albizzia odoratissima*, mixed with *Anogeissus latifolia, Grewia tiliæfolia* and *Kydia calycina* among other species. *Shorea talura, Buchanania latifolia, Anogeissus latifolia* and *Terminalia chebula* form more than 50 per cent of the crop over the rest of the plateau not taken up for clearfelling, and a few trees of these species occur also inside the areas to be clearfelled. Generally speaking the growth is markedly taller than the surrounding crop but *bothai* grass (*Imperatum arundinaceum*) is common over the whole plateau. A few *Mesua ferrea* and *Hopea parviflora* may be noticed but they are confined to the banks of the Suruli stream.

446. The growth below the Kumli ghat road consists partly of unfelled growth of tall specimens of *Stereospermum chelonoides, Adina cordifolia, Schleichera trijuga, Anogeissus latifolia, Dalbergia latifolia* and other species, and partly of standards and coppice regrowth from fuel coupes felled in the past. The soil in the latter area is deep loam of good quality but a luxuriant growth of climbers (*Acacia intsia* mainly) has badly suppressed the coppice.

447. The area selected in the Iruttar valley appears to have been under temporary cultivation before reservation. With the exception of a few tall well-grown specimens of tamarind, mango and *Dalbergia latifolia* scattered over it the growth consists of a tangled mass of coppice shoots and climbers. The soil is deep alluvium.

448. In the Velancombai reserve the locality resembles the unfelled forest near the Kumli ghat road but the soil is mixed up with more boulders and the proportion of clay is somewhat higher.

449. The teak plantations included in this Working Circle have been described in detail in paragraphs 56 and 57 of Chapter II.

450. It may therefore be seen that all the best localities in the deciduous forests of the division suitable for growing plantation teak have been included in this Working Circle, with the exception of the major part of the Vannathiparai valley.

An area of 1,200 acres in this valley is eminently suitable for teak planting and should produce timber of a high quality but planting up is not now prescribed as the problem of protection of teak from elephants has yet to be solved. The steps proposed herein to this purpose need sufficient trial before further extension of the plantations can be prescribed. Also the existing growth of *Schleichera trijuga* on the area is believed to be of considerable potential value for the production of lac, so that it has been decided to reserve the area for the present for the cultivation of lac : the felling of *Schleichera* trees which would be involved in raising teak plantations can scarcely be justified now under the circumstances indicated above.

SECTION 2.—DIVISION OF THE AREA.

451. The Working Circle is divided into the following four felling series :—

Number and name of felling series.	Range.	Area in acres.
(1)	(2)	(3)
1 The Surulipatti felling series ..	Cumbum	480
2 The Kumli felling series	Do. ..	120
3 The Velancombai felling series ..	Palni	55·4
4 The Iruttar felling series	Kodaikanal ..	40

452. The Surulipatti series is confined to the plateau of that name.

The Kumli series is composed of an area of 50 acres below the Kumli ghat road as it commences ascending up the hills and the Vannathiparai teak plantations.

The Velancombai series comprises 15·4 acres of teak plantations in the Velancombai reserve (Palni range) and 40 acres in the same reserve suitable for planting with teak.

The Iruttar series is in the Iruttar valley of the Kodaikanal range. There are facilities for irrigation in this locality, so that irrigated teak will be raised here as an experimental measure.

SECTION 3.—ANALYSIS AND VALUATION OF THE CROP.

453. Of the four felling series prescribed, the Kumli, Iruttar and Velancombai series are each of so small extent that no valuation of the crop was considered to be necessary.

454. The Surulipatti series comprises the best localities on the Surulipatti plateau suitable for the planting of teak and has an aggregate area of some 480 acres.

An area of 62·5 acres of the type selected for planting was enumerated, along with other areas, with a view to arrive at the annual yield from the " Selection Working Circle ". The results of this enumeration are tabulated below for a unit of 10 acres :—

The stand on 10 acres of first quality forest on the Surulipatti plateau.

Number and species.	Number of trees in girth class.								Total number of trees over 3′ in girth.
	3′—4′	4′—5′	5′—6′	6′—7′	7′—8′	8′—9′	9′—10″	Over 10″.	
1 Teak	11·7	2·1	1·4	0·2	0·3	..	0·3	0·2	16·2
2 *Dalbergia latifolia* ..	1·8	1·0	0·3	0·3	..	..	..	..	3·4
3 *Pterocarpus marsupium* ..	14·4	2·7	1·3	0·3	1·0	0·3	0·3	0·2	20·5
4 *Albizzia odoratissima* ..	5·3	3·4	2·9	1·9	0·6	0·2	0·2	..	14·5
5 *Adina cordifolia*	1·8	2·1	1·4	1·8	1·4	0·8	0·8	0·5	10·6
6 *Stereospermum chelonoides*.	1·3	0·5	..	..	..	..	..	..	1·8
7 *Shorea talura*	7·5	2·1	1·6	0·3	0·2	..	..	..	11·7
8 *Grewia tiliæfolia*	18·4	5·3	1·9	0·5	..	..	..	..	26·1
9 *Anogeissus latifolia* ..	44·0	26·1	11·4	3·0	1·4	0·6	..	..	86·5
10 *Terminalia chebula* ..	5·4	2·2	0·3	..	0·2	..	..	..	8·1
11 Miscellaneous	22·1	6·6	4·3	2·1	1·8	1·3	1·1	0·5	39·8
Total ..	**133·7**	**54·1**	**26·8**	**10·4**	**6·9**	**3·2**	**2·7**	**1·4**	**239·2**

***N.B.*—Trees below a B.H.G. of 3 feet were not enumerated.**

455. Areas suitable for planting have been roughly marked on Survey of India sheets to a scale of 4 inches : 1 mile.

Two quality classes have been distinguished on the Surulipatti plateau, on the basis of height growth of the standing trees : both the localities will be planted up.

SECTION 4.—METHOD OF TREATMENT.

456. *Silvicultural system.*—The objects of management are (1) the replacement of the existing growing stock, wherever suitable, by plantations of teak in mixture with other valuable species, such as *Dalbergia latifolia* and *Pterocarpus marsupium*, so as to improve the value of the forests, and (2) the replacement of the trees proposed for exploitation under the "Selection Working Circle" of this Working Plan. The Silvicultural System proposed to secure these objects is "Clearfelling" followed by concentrated artificial regeneration.

457. *Choice of species.*—The demand for teak of all sizes, from poles to large timber, the attractive prices obtained for it, its rapidity of growth, the comparative ease with which it may be regenerated and the suitability of the locality, all point towards its adoption as the principal species. In order to guard against the dangers associated with a crop of pure teak, it will be grown mixed with *Dalbergia latifolia* and *Pterocarpus marsupium* ; other saleable timber species appearing spontaneously in the plantations will also be retained and encouraged.

458. *Exploitable size and rotation.*—An average girth of six feet at breast height, over bark, will be aimed at.

In the Vannathiparai teak plantation of 1870, eleven trees are over 6 feet in girth and 52 are between 5 and 6 feet. In the Velancombai plantation of the same age 23 trees are over 6 feet in girth and 25 are between 5 and 6 feet. These plantations were not thinned as and when necessary. A higher average girth would certainly have been attained had they received proper thinnings.

A more rapid increment in girth can be reasonably expected under irrigated conditions : ten trees planted 40 years ago along a water channel in the Iruttar Valley were found to have an average girth of 5 feet 6 inches.

No definite period of rotation can be fixed, however, on the basis of such meagre data, particularly in view of the fact that the localities concerned differ in quality among themselves and from those for which the data are available. A period of seventy years will be adopted tentatively for the present, primarily with a view to arrive at the annual area to be planted. Such alterations as future data will indicate for each series may be made when this plan comes up for revision.

Annual coupes.

459. *The Iruttar Series.*—In the Iruttar Series the proposed irrigated plantations are primarily of an experimental nature. In view of the fact that we have yet to discover (*a*) whether the timber produced will be of good quality, (*b*) whether irrigation will be necessary throughout the life of the plantation or not, and if so, whether there is sufficient water to irrigate the annually increasing areas, (*c*) whether irrigation is better by percolation or flooding, (*d*) if it should be daily, bi-weekly or less frequent and (*e*) to what extent the interval between two irrigations should vary with the age of the trees, it is essential that the annual areas should be small enough to be treated as sample-plots. An area of *two acres* will therefore be taken up for planting every year in the Iruttar Series.

460. *The Surulipatti Series.*—The area of the Surulipatti Series is about 480 acres. On a tentative rotation of 70 years, the annual planting area is about 7 acres. It has been laid down that the artificial regeneration of gaps created by the fellings prescribed under the "Selection Working Circle" should be confined to a small portion of the area covered by the Working Circle, owing to the difficulty of ensuring fire protection over the rest of the area (vide paragraph 432 of Chapter II of Part II of this Working Plan). In order to compensate in part for the gaps not prescribed for artificial regeneration under the Selection

Working Circle, an area of 10 acres will be taken up every year for clearfelling and planting in the Surulipatty Series. The larger annual area will also help to reduce the cost of formation per acre.

The annual coupes for the next ten years have been indicated in the Working Plan Maps.

461. *The Kumli Series.*—The total area of this series is 120 acres, out of which 66·5 acres are damaged teak plantations in the Vannathiparai Valley, 3·5 acres are under teak raised in 1870 and 50 acres are available for planting adjacent to the Kumli ghat road. No attempt will be made now to constitute a complete series of age gradations: it will be easy to add to it suitable areas in the Vannathiparai Valley so as to supplement the age gradations, when we have learnt how to keep out elephants from these teak plantations successfully and economically as a result of the experiments prescribed elsewhere in this Working Plan (vide paragraphs 480 and 493). An annual area of 10 *acres* will be taken up for planting in this series for the next ten years, five acres in the area demarcated near the Kumli ghat road and five acres in the area occupied by the damaged and unsuccessful plantation of 1920–22, in the Vannathiparai valley.

The regeneration of ten acres every year in this series will compensate further for the gaps *not* prescribed for artificial regeneration under the Selection Working Circle, already referred to in paragraph 460 above.

462. *The Velancombai series.*—The total area of the series is about 55 acres out of which about 15 acres have been planted already. The balance of 40 acres will be planted up in the next 10 years at the rate of 4 acres per year.

463. *The yield.*—The yield will be regulated by area for all the series.

The tabular statement of " Stand of timber trees " given in paragraph 454 above may be used for a rough estimate of the probable outturn from the annual coupes in the Surulipatti and Kumli Series and will help to indicate whether the highest bid at the auction is reasonable.

464. *Method of executing the fellings.*—The next ten annual coupes for all the series have been shown approximately on the Working Plan maps.

The first coupes of two acres in the Iruttar Series will be at the head of the proposed irrigation channel and the subsequent coupes will form a succession of adjoining areas at progressively lower levels. The head of the channel has been indicated in the Working Plan maps: the coupes are of too small an extent to be exhibited accurately on a scale of 4 inches: 1 mile. They have however been shown on the Working Plan maps.

The annual coupes will be laid out on the ground by the Range Officer as indicated above and plans and field books submitted to the District Forest Officer well in advance of the date of sale. They will be sold in auction by the District Forest Officer to contractors who will be required to clearfell them, under agreements in a form similar to that in use in the division. All growth should be cut at a height not exceeding six inches from the ground. No trimming of stools need be done. The lease should terminate by the end of December.

If there is reason to fear that the contractor will remove so much of the slash resulting from fellings as will leave behind a quantity insufficient for a moderate burn, the District Forest Officer may prohibit the removal of slash below a minimum girth to be fixed by him.

SECTION 5.—REGENERATION.

465. *Species.*—The clear-felled coupes in each of the four Felling series will be regenerated primarily with teak. In order to minimise the disadvantages of pure teak woods the teak will be raised in mixture with *Dalbergia latifolia* and *Pterocarpus marsupium* and adventitious tree species that appear naturally on the area will be retained in cleanings, so long as they do not interfere with the growth of the valuable species.

All the three species will be planted out as stumps in the area to be regenerated.

466. *Espacement.*—The primary species, teak, will be planted at an espacement of 6′ × 6′ : the *Dalbergia* and *Pterocarpus* among the teak in *quincunx*, in alternate rows as exhibited below :—

```
T     T     T     T     T     T     T     T
   D           D           D           D
T     T     T     T     T     T     T     T

T     T     T     T     T     T     T     T
   P           P           P           P
T     T     T     T     T     T     T     T

T     T     T     T     T     T     T     T
   D           D           D           D
T     T     T     T     T     T     T     T

T     T     T     T     T     T     T     T
   P           P           P           P
T     T     T     T     T     T     T     T
```

T = Teak. D = *Dalbergia*. P = *Pterocarpus*.

The two subsidiary species should normally be used in equal proportions, but any unexpected deficiency in one may be made good with the other.

467. In the Iruttar series the plantations will be raised under irrigated conditions. In the Kumli series efforts will be made to obtain " Kumridars " to raise field crops along with the tree species.

468. *Seeds.*—Since many of the characteristics of trees are probably hereditary it is essential that seed be collected only from trees of good, straight growth and form. Trees of twisted grain or of low branching habit should be rejected for seed collection but they may be of any age. Seed trees should be selected and reserved permanently for annual seed collection. Local seed should be used as far as possible. Good seed bearers are available on the Surulipatty plateau and on the Vannathiparai and Kumli slopes, for all the required species.

469. *Collection and storage.*—Teak seed is collected off the trees, when ripe, from December to February. The outer spongy covering is removed and the seeds stored in gunny bags under cover. No selection or rejection of seed on account of size should be done as small seeds do not give appreciably poorer results than seeds of average size. One bag weighs on the average 65 lbs. About 750 seeds go to the pound. Normal germination is 60 per cent, with a plant per cent of 55.

Dalbergia latifolia pods are collected from March to May, well dried and stored in gunnies. One bag holds about 50 Madras measures. About 600 pods go to an ounce. The plant per cent is about 50.

Pterocarpus marsupium pods are collected in February–March, and well dried and stored in gunnies : one bag holds about 50 Madras measures. About 55 seeds go to an ounce. The germination per cent is high and the plant per cent is about 85.

Nursery.

470. Nurseries will be required for raising stumps of teak, *Dalbergia latifolia* and *Pterocarpus marsupium*. Four nurseries may be required, one for each series, but there is no objection in growing all the stumps required in one or two central nurseries, if it be found convenient.

471. *Site.*—The site for the nursery should be on well drained sandy or loamy soil preferably with an admixture of decomposed humus in the surface layers, such as is found in clearings in mixed deciduous forest of good quality. Suitable localities will be found on the banks of the Suruliar, the Iruttar and the river at Velancombai.

472. *Type.*—Permanent nurseries are recommended as the annual areas to be planted are small and adjoin one another. If deterioration is noticed as a result of repeated use of the same area, a rotation of crops or the use of leaf mould, wood ash or green manure may be necessary. The Provincial Silviculturist may be consulted if such a contingency arises.

473. *Preparation of the site.*—The forest growth on the site should be clearfelled and burnt. In the case of a teak nursery the clearfelling should extend beyond the actual nursery site to a distance at leat equal to the height of the surrounding forest so that none of the beds may be affected by side shade. Small stumps should be uprooted. The area should be fenced against cattle and game, if such danger exists.

474. *Formation of beds.*--The whole area should be dug over at last 12 inches deep. The beds should then be formed with sides 9 inches high supported by split bamboos, saplings or any other convenient material, in order to *ensure good drainage.* The beds may be 4 feet wide and separated from each other by paths 9 inches to 12 inches wide. The length of the beds may be adjusted to fit the nursery area but should normally be not less than 25 feet to 30 feet ; (40′ × 4′ is regarded as the standard size). Paths should be left between the ends of the beds at least 18″ wide and at least 5′ should be left between the fence and the beds all round which should be kept clear of weeds. The beds should be dug over and reformed each year they are used.

475. *Size of nursery.*—One bed, 40′ × 4′, should produce 1,200 to 1,500 stumps of teak if fully stocked. Two such beds for each acre of 6′ × 6′ planting will allow for original planting, for badly stocked beds, for replacement of casualties and unforeseen emergency. Any excess can be utilised in the second year and the nursery for that year reduced in size proportionately.

Of the secondary species, (*Dalbergia latifolia* and *Pterocarpus marsupium*) about 1,800 stumps may be expected from a standard bed, which will allow for 3 acres of planting in quincunx in alternate rows in mixture with the teak.

476. *Sowing.*—In order to ensure that fully stocked beds are obtained under the most unfavourable conditions, dense sowing is advocated at present : from 50 to 80 lb. of teak seeds per bed of 40′ × 4′ have been found satisfactory : this corresponds to an espacement of $\frac{3}{4}$″ × 3/5″. The Provincial Silviculturist is conducting experiments to determine the best quantity of seed to use and he should be consulted periodically on this point. The seeds should be sown on the beds as early in April as possible, without any pre-treatment. Experiments are in progress to determine really efficient methods of pre-treatment and the Provincial Silviculturist should be consulted on this point also from time to time.

The pods of *Dalbergia* should be broken up before sowing and those of *Pterocarpus* soaked for 48 hours in an emulsion of cowdung and water. The pods should be sown early in April, a bag of seeds (50 Madras measures) being used for a standard bed.

477. *Tending.*—Nursery beds should be kept clean weeded and the soil loosened between plants now and then when it becomes hard. Experiments by the Provincial Silviculturist are in progress to determine whether thinning and pricking out of seedlings in nursery beds is advisable, but until definite results are obtained it is prescribed that no such operations should be carried out as a routine measure, except in collaboration with the Provincial Silviculturist. Normally no shading of beds is necessary, particularly in the case of teak. If considerable casualties occur in the early hot weather before the stumps are dug out, shading the beds from December onwards may help to diminish the casualties but experiments are required to decide this.

478. *Outturn.*—One year old stumps raised as described above should be of a convenient size for planting.

Teak stumps under 0·3 inches diameter or over about 0·9 inches diameter at the root collum do not give such good results, so that only stumps within that range should be used, as far as practicable.

The teak plants should be pulled up after softening the soil by watering and loosening it with a pointed stick, the larger plants being taken first. The beds should then be properly consolidated and if possible watered, in order to ensure that the plants left will continue to thrive so that they may yield good big stumps for replacing casualities later in the year, and for original planting in the following year.

In making stumps it is essential to use a sharp knife ; all small side roots should be trimmed off flush with the main root and the stem should be cut off about one inch above the collum. Nine inches of root is normally left but any length over about 4 inches is suitable and gives equally good results. It is better to have the root short, than to have it long and thin, as in the latter case coolies are inclined to twist or crumple it up when pushing it into the crow-bar hole, and this has a bad effect on the growth of a plant throughout its life.

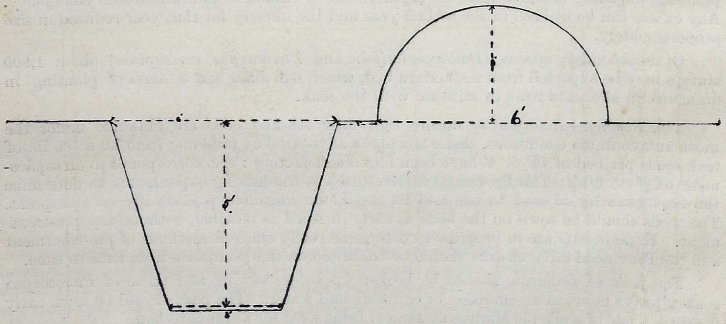
Under no circumstances should sowing for the next year's stumps be delayed because stumps have not been made. If planting is likely to be late and the clearing of the beds thus delayed, some new beds should be formed and sowed for the next year's planting. Delayed sowing will result in poorly stocked beds and thin stumps.

479. *Cost.*—In a properly managed nursery the cost of production including clearing the site, fencing, cost of seed, etc., should not exceed Rs. 3 to Rs. 4 per 1,000 stumps.

Preparation of planting site.

480. *Protection against game.*—The Vannathiparai teak plantations of 1920–22, covering an area of 50·5 acres, will be protected against the ravages of wild elephants by a trench dug all round it. Experience has shown that plantations of teak in this locality have no chance of success unless they are effectively protected against elephants. The soil is deep and soft and trenches can be dug with ease.

The trench should be six feet wide at the top, three feet at the bottom and five feet deep. It should be dug sufficiently inwards from the edge of the streams bordering the east and west of the area in order to avoid stony soil adjoining the stream. The earth dug out should be piled up along the plantation side of the trench, in an unbroken wall a foot away from the edge : please see diagram below :—



The benching of one foot is intended to minimise the washing down of the made earth into the trench.

The trench should be carried through across dry streams, and should be continually kept in repair to prevent it getting filled up by the action of rain and so on. If the stream-bed be rocky or if it be a *running* stream a bit of wire rope should be slung across convenient trees on the banks, as prescribed for the experimental plot of 15 acres in paragraph 493 below.

The estimated length of trench to go round the area is 80 chains. This length of trench will cost about Rs. 600 at Rs. 5 per unit of earth work (1,000 c.ft.) and will protect about 50 acres.

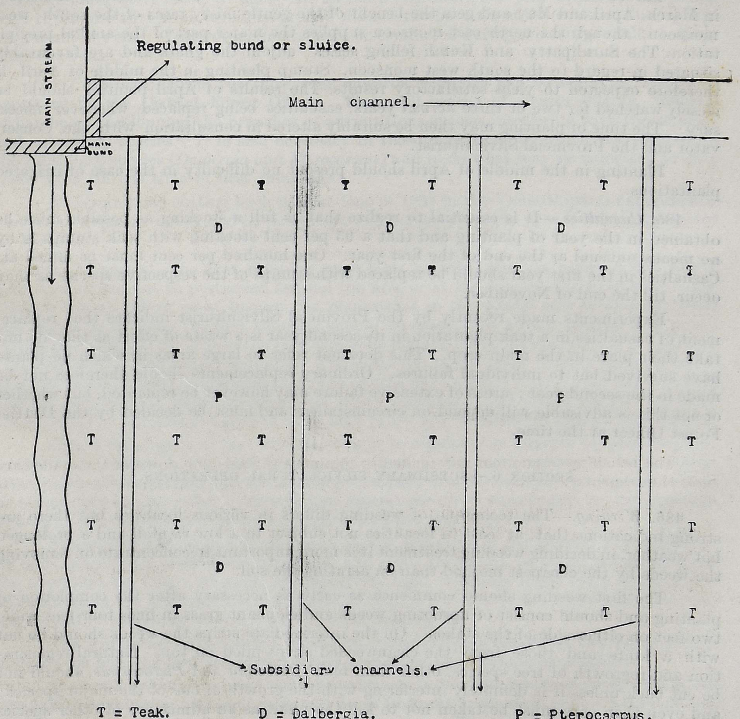
The trench should be dug all round the teak plantations before any fellings or planting is taken up inside. It should be kept in a sufficient state of repair to be effective against wild elephants.

481. *Burning.*—As soon as the contractor has relinquished a coupe at the end of December, a *fire line* 20 feet wide should be cut all round it and burnt. In the Vannathi parai teak area no fire line is necessary where elephant trenches have been dug. Any coppice shoots or other standing growth should then be cut down and allowed to dry on top of the slash left by the contractor. The area should then be burnt by about the middle of February and piling and reburning of the material left after the first burn completed by the middle of March. Piling and reburning are expensive, so it is desirable to aim at a thorough and even burn in the first instance.

482. *Lining and staking.*—The general espacement will be 6 feet × 6 feet for teak, in all series, except for the experimental area indicated below. The subsidiary species will be planted in quincunx in alternate rows as described in paragraph 466 above. The lining will be done as described in the Madras Forest Pocket Book. Stakes two to three feet long should be driven firmly into the ground at all the points to be planted. This should be completed by the 10th of April.

When staking the regeneration area in the Vannathiparai teak plantations the lay out should follow that of the original planting. No planting need be done where a teak planted originally has survived, so that the stakes should be put in only where fresh plants have to be put out. A compromise in espacement may be found necessary in places, since the original espacement was 8 feet × 8 feet in some places and 6 feet × 6 feet in others. It should be clear by the 10th of April which of the teak originally planted are fit to take their place in the final crop.

483. *Formation of water channels and bunds.*—In the case of the Iruttar series a system of water channels should be dug over the area in order to irrigate it. The channels will be 1 foot deep, with a cross section of 1 foot × 1 foot and will be laid out in the manner indicated below :—



T = Teak. D = Dalbergia. P = Pterocarpus.

A temporary main bund across the main stream (Talaiar) should be constructed of strong wattle fence and puddle and kept in position by means of stout posts driven firmly into the ground. Provision must be made at one end to take off any water that may accumulate at the bund over and above the required level. This temporary bund will have to be reconstructed after the north-east monsoon as it is almost certain to be washed away in heavy rains.

A temporary regulating bund across the main channel will help to regulate the supply in our irrigation system.

The location of the *main bund* across the Talaiar has been shown in the Working Plan map.

484. *Planting.*—Stumps will be planted in crowbar holes without any soil working, whenever possible. Care must be taken that (*a*) the crowbar hole is the correct depth for the stump to be planted with the collum level with the main ground, (*b*) no space is left round the tip of the stump when planting, (*c*) that the tip of the stump is firmly gripped in the soil—this would be achieved by driving in the crowbar or pointed stick close to the stump and levering it away from the stump and so that the point of the stick presses the earth towards the stump ; the bottom of the stump should be firmly gripped by the soil before the upper part of the hole is filled up, and (*d*) the upper part of the stump is firmly consolidated, so that the stump should resist a fairly strong pull.

The best date of planting has to be determined for each locality separately, but it has been established that, in places with a West Coast type of climate, the best date is about the middle of April, i.e., about six to seven weeks before the monsoon sets in. This early planting gives a great increase in height growth over planting at the beginning of the monsoon. The risk of failure is slight and can be cheaply insured against by keeping a stock of stumps for replacing casualties at the beginning of the monsoon.

The southern end of the Cumbum valley normally receives "summer showers" in March, April and May and gets the benefit of the gentle misty rains of the south west monsoon, though the north east monsoon supplies the major part of the annual precipitation. The Surulipatty and Kumli felling series adjoin the ghats and are favourably situated in regard to the south west monsoon. Stump planting in the middle of April is therefore expected to yield satisfactory results. The results of April planting should be closely watched for two or three *normal* years, casualties being replaced whenever necessary. The time of planting may then be suitably altered in consultation with the Conservator and the Provincial Silviculturist.

Planting in the middle of April should present no difficulty in the case of irrigated plantations.

485. *Casualties.*—It is essential to realize that as full a stocking as possible must be obtained in the year of planting and that a 95 per cent stocking with teak stumps is by no means unusual at the end of the first year. One hundred per cent must be aimed at. Casualties in the first year should be replaced with stumps of the respective species as they occur, till the end of November.

Experiments made recently by the Provincial Silviculturist indicate that replacement of casualties in a teak plantation in its second year is a waste of effort as they do not take their place in the main crop. This does not refer to large areas in which no plants have survived but to individual failures. Ordinary replacements should therefore not be made in the second year ; areas of extensive failure may however be replanted, but whether or not this is advisable will depend on circumstances and must be decided by the District Forest Officer at the time.

SECTION 6.—SUBSIDIARY SILVICULTURAL OPERATIONS.

486. *Weeding.*—The technique of weeding differs in various localities but there are strong indications that, at least in localities not subject to a low rainfall and a prolonged hot weather, in deciding weeding treatment it is more important to concentrate on removing the weeds by the cheapest method than on aerating the soil.

The first weeding should commence as early as necessary after the completion of planting and should consist of uprooting weeds and elephant grass in lines four feet wide, two feet on either side of the stakes. On the intermediate strips the weeds should be cut with a knife and those from the cleanweeded strips piled on top. Natural regeneration and regrowth of tree species, other than teak' *Dalbergia* and *Pterocarpus*, should not be cut back unless it is definitely interfering with the growth of one of the major species ; and even then care must be taken not to kill the plant as an admixture of other species

in a teak plantation is desirable. Lantana should be uprooted wherever found. Bamboo regrowth should be cut back to ground level as often and as soon as young shoots appear, so as eventually to kill the clump if possible. Weeding should progress in lines along the contour and the weeds should be thrown in the middle of the strips running along the contour so as to prevent soil wash during rains. Casualties noticed at the time of weeding should be promptly replaced.

No definite prescriptions can be laid down either in regard to the method of carrying out subsequent weedings or to their number, in view of the variable conditions involved and our incomplete knowledge of the best methods under different conditions. Full use should be made of the latest methods studied by the Provincial Silviculturist and he should be consulted periodically.

A mamti scraping may be done in lines two feet wide on either side of each line of stakes early in September, and another in December soon after the North East monsoon has ceased. The lines should follow the contours so as to minimise erosion. This scraping will be found to be particularly beneficial on the Surulipatti plateau where " elephant grass " prevails.

Subsequent weedings must be done as they become necessary. But if the area has been well burnt and these first two operations are well done, nothing further should be necessary until about January to February, when another scraping will probably be beneficial.

Two or three weedlings will be required in the second year which may be done on lines similar to those indicated above. No weeding is likely to be necessary in the third year, but if it be found essential it may be carried out in consultation with the Conservator.

487. *Pruning and cutting back.*—Seedlings damaged by borers, wind, elephants or other causes should be promptly and neatly cut back at ground level. Multiple shoots from stumps should be reduced to one. All forked stems and *stout* side branches competing with the leader should be carefully pruned *flush* with the main stem, without tearing the bark round the cut. These operations should be conducted during the course of all weedings after the first.

488. *Cleanings.*—From the third year onwards cleanings will be made as considered necessary by the District Forest Officer. They will consist of creeper cutting, removal of bamboos, and lopping the branches of adventitious species interfering with the primary and subsidiary species. It is also necessary in these operations to watch the progress of the subsidiary species (*Dalbergia* and *Pterocarpus*) and to do what may be necessary to keep them alive till the time of first thinnings.

A cleaning and cutting back will be done in 1937 in the Vannathiparai experimental plot of 15 acres, as prescribed in paragraph 493 below, after the area has been protected by wire rope.

489. *Thinning.*—The first thinning may have to take place as early as the fourth year, and should not be postponed beyond the fifth or at the outside, the sixth year. The District Forest Officer must inspect the plantations in the fourth and subsequent years and decide as to when the first thinning should be made. In a fully stocked well grown plantation nearly 50 per cent of the crop should be removed, and the operation will approach very nearly to a mechanical thinning. Thinnings are rarely made heavily enough, and it must be borne in mind in marking that teak crowns have a great capacity for rapid growth and the canopy soon closes up even after heavy openings ; and that a big girth is to be aimed at rather than height growth since high prices are obtained for logs of big diameter

One of the objects of this first thinning is to regulate the mixture of subsidiary an adventitious species in the teak plantation. Teak is the main species to be favoured, after which the subsidiary species, *Dalbergia latifolia* and *Pterocarpus marsupium*, should be encouraged in that order. Adventitious species should be encouraged, in any quantity, so long as it does not interfere with the growth of the major species.

Subsequent thinnings will take place at the discretion of the District Forest Officer ; he must inspect his plantations frequently and great care must be taken not to postpone the operation too long ; frequent comparatively light thinnings made early in the life of the plantation are very much more beneficial than a late heavy one made when the trees are too old to be able to respond readily to the opening up.

The Provincial Silviculturist should be consulted periodically in this all important matter ; he has well laid out and carefully controlled experiments in progress.

It should be borne in mind that the tendency in the past has been to err on the side of insufficient thinning. Thinnings should be as frequent as possible and as heavy as they can be without making a lasting break in the canopy. They should encourage the subsidiary species to form a mixture with teak and not an underwood. Adventitious species

should also be encouraged provided they do not interfere with the growth of the more valuable trees. *Loranthus* should be eradicated by cutting off branches infected with it and burning them.

The operation of thinning requires considerable skill and should be conducted by the District Forest Officer in person over appreciable areas. It should not be entrusted to any other than a Gazetted Officer or a Ranger specially trained for the purpose.

490. *Kumri regeneration.*—The plantable area adjoining the Kumli ghat road is easily accessible to the villagers of Gudalur and Thammannagowndanpatti and adjoins dry fields under cultivation. The demand for land in the Cumbum Valley is keen. It is therefore anticipated that villagers will be quite ready to take up areas in this series for "Kumri." Attempts should be made to regenerate as much as possible of the annual coupe in this series in this manner. If the whole coupe is not taken up for Kumri cultivation the balance will be regenerated departmentally as described in the preceding paragraphs.

The plantable area inside the elephant trench prescribed in paragraph 480 can also be regenerated under the "Kumri" system by the Paliyans settled at Vannathiparai.

The area to be regenerated will be handed over to the kumridar on his executing a suitable agreement with the District Forest Officer.

The conditions to be laid down should be on lines something as follows :—

(1) The area to be regenerated to be handed over to the kumridar by the first week of January, on the completion of the main felling and extraction.

(2) The kumridar to cut, pile up, and burn all slash free of cost before the middle of March (so as to avoid April showers which would interfere with burning) under departmental supervision, in order to be sure that the operation is properly done. Too severe a burn concentrated on small areas is likely to result in baking the soil which is not conducive to good growth ; this should be guarded against. A good not too intense burn, as even as possible over the whole area, should be aimed at.

(3) The kumridar to supply to the department, whenever required, sufficient labour, at the usual market rates, for all departmental operations in the area, such as lining, staking, dibbling, planting and replacement of casualties.

(4) The kumridar to prepare the soil over the patches to be planted, free of cost, along with the soil preparation for his agricultural crop and in the same manner.

(5) The kumridar to be permitted to cultivate the area for one year with any of the following crops :—

Ragi (*Eleusine coracana*), cholam (*Sorghum vulgare*), thenai (*Setaria italica*), kambu, (*Pennisetum typhoides*) or cotton.

(6) The kumridar to keep the plants at each stake *clean weeded at all times* to a radius of 18 inches round it, free of cost.

(7) If the kumridar has performed his obligations to the satisfaction of the District Forest Officer, he will be entitled to take the agricultural crop he has raised in return for the free labour he had provided for felling and burning the area and keeping the plants well weeded.

Experimental.

491. *Surulipatti series.*—The elephant grass, *Imperatum arundinaceum*, grows thick and high on the Surulipatti plateau. It is likely that a reduction in the planting espacement may result in a quicker suppression of this grass and diminished weeding costs, but at the same time there will be an increase in cost on account of the extra planting involved. In order to decide what espacement will be ultimately the most economical and efficient, one acre in the Surulipatti series will be planted with teak at 3 feet × 3 feet, and another acre at $4\frac{1}{2}$ feet × $4\frac{1}{2}$ feet, every year, for the first four years. No subsidiary species will be planted in these experimental areas. At the end of this period it should be possible to fix the method of future planting with reference to the comparative results obtained and costs incurred. The District Forest Officer, in consultation with the Conservator, will then decide the future espacement for all teak plantations on the Surulipatti plateau.

492. *Iruttar series.*—Our knowledge of the requirements of teak (and other species) grown under irrigated conditions, and its rate of growth, the quality of the timber it will produce and other matters, is very limited. In order to enable us to study the subject in detail, it is essential that the proposed plantations in the Iruttar series should be treated as experiments and subjected to careful observations and measurements in order to find out the various facts we do not know about irrigated plantations. The nature of such experimental work on trees demands that the treatment and observations should be spread over a period of time which will be sufficiently long to yield conclusive results. It is necessary that fresh areas should be available for annual planting in the selected locality for this period of time. To secure continuity of experiment and observation over a sufficient period of years the annual area to be planted should not exceed the two acres prescribed above.

The main points to be decided are—

(1) Whether irrigation is better by percolation or flooding ?

(2) What frequency of irrigation yields the best results at a particular age, and how this optimum frequency varies with the age of the crop ?

(3) At what age irrigation ceases to exercise any beneficial effect on the trees and when it may be discontinued ?

(4) Whether irrigation will affect the quality of the timber produced adversely or beneficially ?

In the first two years the District Forest Officer will confine his experiments to (1) a simple comparison of the merits of percolation as against flooding, and (2) a comparison of two frequencies of irrigations, viz., on alternate days and once a week.

Subsequent experiments will be decided upon by the District Forest Officer in consultation with the Provincial Silviculturist with reference to indications and results obtained.

SECTION 7.—MISCELLANEOUS PRESCRIPTIONS.

493. *Vannathiparai experimental plot*: 15 *acres*.—A reference to paragraphs 56, 166 and 313 of Part I of this Working Plan will show that teak plantations raised in the Vannathiparai valley in the years 1920–22 and 1928–30 have been subject to periodical damage by wild elephants.

The plantations are situated in two different localities—an area of 50·5 acres which includes the 1870 plantations, and an experimental plot of 15 acres along the cart-track to Medagran mettu. The block of 50·5 acres will be protected by a trench 6′ × 5′ × 3′ dug all round it, as prescribed in paragraph 480 above.

The block of 15 acres will be protected by means of wire ropes slung from tree to tree along its edge. Old wire rope of 7/8 inch diameter may be purchased from the General Manager, The Kannan Devan Hill Produce Company, Limited, Munnar (Travancore) at Re. 0–3–0 a yard, delivered at the bottom of their ropeway system, 10 miles from Bodinaikanur. The cost of collection will be about Rs. 25, per 1,000 yards. The rope should be fixed to standing trees of a foot or more in girth, round the plantation, by passing it once round the trees, and must be stretched as tightly as possible by hand. The trees may be selected at intervals of about 12 feet and the height at which the rope is passed round the tree should be so adjusted that, when the rope is tightened finally, its minimum height from ground level will be about 4 feet 9 inches. "Bull-dog" clips to join ends of ropes together may be bought of Messrs. Cobbold & Co., Ltd., Mercantile Buildings, Lall Bazaar street, Calcutta, at about Rs. 1–8–0 each.

Two or three wedge-shaped blocks of wood should be inserted between the trees and the rope to allow of the trees putting on increment without imbedding the rope. The wedges will help to tighten the rope if necessary subsequently if they are driven further in. The approximate cost of this operation is indicated below :—

	RS.
1,600 yards of 7/8″ wire rope, at Re. 0–3–0 a yard	300
Collection charges at Rs. 25 per 1,000 yards	40
Transport to Vannathiparai in 6 cart-loads	60
Staples and bull-dog clips and labour for fixing	60
Contingencies, including wooden wedges, etc.	40
Total ..	500

This work should be completed before the end of January 1937.

As soon as the wire rope has been fixed satisfactorily, the plot of 15 acres should be properly tended. The area carries a very fair stock of teak and supports, in addition, a considerable mixture of promising poles of *Dalbergia latifolia*, among a mass of *Melia dubia*, *Stereospermum chelonoides* and miscellaneous species. The latest report from the Provincial Silviculturist indicates that cutting back and burning a teak plantation does not appear to be desirable unless under special circumstances. The presence of a large number of promising poles of *Dalbergia latifolia* and other species inside the area makes any prescription to cut back and burn the area undesirable. The plantation will therefore be cleaned thoroughly without a general cut back and burn. All teak damaged by elephants should however be cut back clearly at groundlevel. Particular care should be exercised with regard to the *Dalbergia* poles which should be encouraged as a subsidiary species second only to teak. The *Melia dubia* and other interfering miscellaneous species should be drastically cut out wherever they interfere with the teak or the *Dalbergia*. This work should be done in February and March 1937, before the teak has commenced its spring growth.

A further cleaning should be done in 1938 if found necessary, in order to free the resulting regrowth of teak from any overwhelming growth of miscellaneous species.

Further tending of this area will depend on the results achieved and is left to the discretion of the District Forest Officer. It is expected that the wire rope will keep the elephants out : this should be watched, and results entered in the control journal.

494. *Teak plantations of* 1870.—The Vannathiparai teak plantation of 1869–70 covers an area of 3·4 acres and contains 156 trees, of which 11 are over 6 feet in girth, 52 are between 5 feet and 6 feet, 69 are between 4 feet and 5 feet and the rest below 4 feet. The plantation was thinned in 1919, 1921 and 1922 but the coppice shoots from the cut stools have remained insignificant. The trees in the plantation are getting stag headed and their bark has been damaged by elephants.

In the Velancombai plantation (4·5 acres) of the same age, there are 23 trees over 6 feet in girth, 25 trees between 5 feet and 6 feet, 73 trees between 4 feet and 5 feet and 130 trees between 3 feet and 4 feet. Of the 226 trees below a girth of 3 feet, 141 are either coppice shoots resulting from the thinnings of 1916 or are much suppressed and are below a foot in girth.

Selection fellings in these plantations are not likely to result in any useful coppice regeneration from stools. And the Velancombai plantation is not likely to respond to any thinning at this age.

Both the Vannathiparai and Velancombai plantations of 1870 will therefore be clear felled, the latter in 1936–37, and the former in 1937–38, after the trench prescribed in paragraph 480 has been completed. The felling and coppicing of stools shall be done departmentally. If the stools fail to send out vigorous coppice shoots, the area covered by the plantations should be planted up with teak in the following years.

495. *Fire protection.*—All plantations should be protected against fire by cleared lines 20 feet wide all round, the internal lines between plantations being limited to a width of 10 feet. Open fire lines from which all growth has been cut out are advocated. These lines should be firetraced at the commencement of the fire season and kept clear of all inflammable material throughout the hot weather by sweeping and burning at intervals.

The whole of the Surulipatti plateau will be closed to all grazing and collection of minor produce will be made departmentally—Vide paragraph 441 under "Working Plan for the Selection Working Circle." In addition to these prescriptions, a system of external firelines will protect the growth on this plateau—Vide paragraph 798. These measures will afford additional protection for the plantations of the Surulipatti series.

496. *Inspection paths.*—The firelines round the plantations will also serve as inspection paths. A strip 6 feet wide, between two rows of plants and running approximately in the middle along the contour throughout the length of the plantation, should be kept clear of all growth, to facilitate inspection.

497. *Demarcation.*—Stone pillars, not less than 2½ feet high above ground level and 15 inches wide, will indicate the year of formation : no other information is necessary. Pillars should be placed at the four salient corners. Pillars at the common boundary of two adjacent plantations will bear the years of formation of both.

498. *Cost of formation.*—The following is the estimated cost of formation of the plantations in the different series : the rates are based on work done on other districts and may require considerable modification in the light of experience to be gained in this division :—

Cost of formation of Teak plantation.

Operations.	Cost per acre. Irrigated. RS. A. P.	Unirrigated. RS. A. P.	Kumri. RS. A. P.
First year.			
Felling, heaping and burning	4 0 0	4 0 0	..
Aligning and staking	2 8 0	2 8 0	2 8 0
Digging irrigation channels and irrigating	25 0 0	..	..
Stumps (1,500)	5 0 0	5 0 0	5 0 0
Planting	3 8 0	3 8 0	3 8 0
Replacing casualties	1 8 0	1 8 0	1 8 0
Weeding	7 0 0	9 0 0	..
Total ..	**48 8 0**	**25 8 0**	**12 8 0**
Second year.			
Weeding and pruning	5 8 0	5 8 0	5 8 0
Repairs to channels and irrigating	15 0 0	..	..
Total ..	**20 8 0**	**5 8 0**	**5 8 0**
Grand total ..	**69 0 0**	**31 0 0**	**18 0 0**

SECTION 8.—CONTROL.

499. The following control records shall be maintained separately for this Working Circle :—

(*a*) The Control Book,
(*b*) The Record of Works,
(*c*) The Nursery Ledger, and
(*d*) The Regeneration Ledger.

Standard forms have been prescribed which will be found in Appendix VI (*a*), (*c*), (*j*) and (*l*).

Tabular statement of fellings—Clearfelling Working Circle.

Serial number and name of felling series.	Year. 1936–37. Coupe number.	Area.	1937–38. Coupe number.	Area.	1938–39. Coupe number.	Area.	1939–40. Coupe number.	Area.	1940–41. Coupe number.	Area.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		ACS.		ACS.		ACS.		ACS.		ACS.
CUMBUM RANGE.										
1 Surulipatti series	I	10	II	10	III	10	IV	10	V	10
2 Kumli series—										
(*a*) Vannathiparai	I	5	II	5	III	5	IV	5	V	5
(*b*) Vairavanar	I	5	II	5	III	5	IV	5	V	5
PALNI RANGE.										
1 Velancombai series	I	4	II	4	III	4	IV	4	V	4
KODAIKANAL RANGE.										
1 *Iruttar series	I	2	II	2	III	2	IV	2	V	2

Serial number and name of felling series.	Year. 1941–42. Coupe number.	Area.	1942–43. Coupe number.	Area.	1943–44. Coupe number.	Area.	1944–45. Coupe number	Area.	1945–46. Coupe number.	Area.
	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
		ACS.		ACS.		ACS.		ACS.		ACS.
CUMBUM RANGE.										
1 Surulipatti series	VI	10	VII	10	VIII	10	IX	10	X	10
2 Kumli series—										
(*a*) Vannathiparai	VI	5	VII	5	VIII	5	IX	5	X	5
(*b*) Vairavanar	VI	5	VII	5	VIII	5	IX	5	X	5
PALNI RANGE.										
1 Velancombai series	VI	4	VII	4	VIII	4	IX	4	X	4
KODAIKANAL RANGE.										
1 * Iruttar series	VI	2	VII	2	VIII	2	IX	2	X	2

* The coupes being too small are not indicated in the management maps.

CHAPTER IV.—WORKING PLAN FOR THE FUEL WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

General Constitution.

500. All areas situated in the various ranges of the division that have been already allocated to fuel working under the several plans and schemes in force, are included in this Working Circle. Modifications have however been made (1) excluding certain areas considered unfit for exploitation owing to poverty of growth resulting from rocky soil or excessive erosion, (2) annexing certain areas because of improved extraction methods and facilities which did not exist when the original plans were prepared, (3) including poorly stocked areas primarily with a view to their improvement by means of artificial "rab" regeneration as prescribed herein, (4) including areas left unfelled owing to wrong survey of coupes which had consequently excluded areas intended for inclusion according to the current plans, (5) including fresh areas where additional fuel series are considered necessary to meet local demands and (6) including the plantations situated in the Palnis, of *Eucalyptus globulus* and *Acacia dealbata* (Australian wattle).

It is considered that a single working circle for the whole division containing all the fuel areas suitable for exploitation will help to simplify their management without detriment to the growing stock. All the fuel felling series in the division have therefore been constituted into one Fuel Working Circle.

The total area of the Fuel Working Circle is approximately, 167,157 acres or 261·2 square miles.

501. The upper limits for remunerative working of a fuel felling series depend largely on the degree of demand for fuel, the nature of the produce extracted, the current sale rates, the avilability of suitable labour combined with the efficiency of its organization, the methods of extraction in common use and, not the least important of all, *local customs and practice.*

The methods of exploitation of fuel coupes by contractors in the commercial fuel series of the Madura division are perhaps better organized than elsewhere in the Madras Presidency. Earth slides, and sometimes simple wire ropes, convey the firewood to cart-tracks constructed by the contractors, often running well up the hillsides. In addition to village carts, motor lorries are sometimes employed to convey the material to the railway stations. The height to which a hillside can thus be exploited has been carried up to about 3,000 feet in suitable localities. This local practice has been borne in mind in fixing the upper limits of felling series.

502. Labour is obviously not scarce and is well organized for the required work.

503. Where extraction of charcoal has been the practice, higher elevations are being worked up to and this fact has also been taken into consideration.

504. However, though the working is intensively organized, there are various shrines and temples in the forest held in respect or awe by the villagers, in the vicinity of which they cannot be induced to fell trees. This fact had not been sufficiently recognized when the existing plans were prepared so that deviations from the prescribed working have had to be made in some cases. Such areas have been excluded, to the minimum extent necessary, from the concerned fuel felling series.

505. In the case of fuel series which supply the demand from villages the extraction is usually in headloads. This practice has been considered in fixing the boundaries of such fuel series.

Character of the vegetation.

506. A detailed description of the type of forest included in this Working Circle will be found in Chapter II of Part I of this plan, in paragraphs 47—54. Generally speaking the forests belong to the mixed deciduous type. Their quality differs widely from place to place as a result of soil conditions, and of the intensity of exploitation, licit or otherwise, that a particular area has been subject to. Areas which were once under cultivation but which were brought later under reservation contain open scrub of poor fuel value, as also areas heavily overworked for firewood, and areas subject to browsing of goats and removal of manure leaves, such as parts of the Waguthumalai and the Alagar Hills reserves. Against this poor type we have also fuel forests of good quality composed largely of *Albizzia amara* or *Acacia planifrons* as in the Natham and Ayyalur ranges, from which an output of 8 to 10 tons of firewood per acre is not unusual.

507. Differences in composition and growth consequent on the different methods of treatment under which coupes have been felled are also noticeable. Thus areas worked under the "Coppice with standards" system, which prevailed, almost exclusively, up to 1916, present a different appearance from those worked subsequently under the "pure coppice" system and are easily recognizable. And those into which goats were admitted to browse in the past but which have not been as yet subjected to a recognized method of silvicultural exploitation may be distinguished by the almost pure crop of mature or overmature *Albizzia amara* standing on them.

508. The representation of the various constituent species also differs with locality: the subjoined statement exhibits roughly their frequency of occurrence in the six ranges of the division :—

Kodaikanal Range.

Albizzia amara.
Grewia hirsuta.
Sapindus emarginatus.
Albizzia lebbek.
Gyrocarpus jaquinii.
Proteum caudatum.
Acacia latronum.
Diospyrus montana.
Anogeissus latifolia.
Tectona grandis.
Limonia acidissima.
Zizyphus xylopyra.

Palni Range.

Albizzia amara.
Gyrocarpus jaquinii.
Canthium didymum.
Proteum caudatum.
Acacia planifrons.
Diospyros species.
Erythroxylon monogynum.
Strychnos nuxvomica.
Albizzia lebbek.
Albizzia odoratissima.
Acacia leucophloea.
Anogeissus latifolia.

SHOLAVANDAN RANGE.

Albizzia amara.
Acacia latronum.
Acacia planifrons.
Dichrostachys cinerea.
Elaeodendron glaucum.
Atalantia monophylla.
Proteum caudatum.
Limonia acidissima.
Chloroxylon swietenia.
Diospyrus montana.
Canthium didymum.
Gyrocarpus jaquinii.

CUMBUM RANGE.

Anogeissus latifolia.
Albizzia amara.
Sapindus emarginatus.
Proteum caudatum.
Strychnos potatorum.
Cordia myxa.
Dalbergia paniculata.
Premna integrifolia.
Wrightia tinctoria.
Grewia tiliaefolia.
Dalbergia latifolia.

NATHAM RANGE.

Albizzia amara.
Chloroxylon swietenia.
Atalantia monophylla.
Canthium didymum.
Gyrocarpus jaquinii.
Erythroxylon monogynum.
Limonia acidissima.
Premna integrifolia.
Proteum caudatum.
Acacia latronum.
Diospyrus montana.
Wrightia tinctoria.

AYYALUR RANGE.

Albizzia amara.
Chloroxylon swietenia.
Acacia planifrons.
Acacia latronum.
Premna integrifolia.
Canthium didymum.
Diospyrus montana.
Limonia acidissima.
Acacia leucophloea.
Dichrostachys cinerea.
Gyrocarpus jacquinii.

509. *Gyrocarpus jacquinii, Proteum caudatum* and *Euphorbia trigonum* are softwooded species of no fuel value. These species form a high proportion of the stock in certain localities, e.g., the eastern end of Pillayarnatham valley (Ayyalur range) the Amburuvi series of Kodaikanal range, and the Poombarai Vilpatty slopes.

510. Sandal occurs in considerable quantities in parts of the Endlaparai fuel series and in the Sathiar valley of the Sholavandan range and in the Kombai series of the Cumbum range.

511. The Eucalyptus plantations of the Gundan Shola Reserve Forest raised between 1887 and 1895 cover an area of 235 acres. The crop is very uneven, consisting of trees of large dimensions mixed with a larger number of suppressed stems of all sizes, due to want of proper thinnings. An area of one acre was clear felled for fuel in 1923–24.

512. The wattle plantation at Poombarai is 16·8 acres in extent and was raised in 1887. The stand consists of over-mature and wind-fallen trees of large size interspersed with considerable quantities of natural regeneration from seed and root suckers, of all sizes. An area of about 3 acres of wattle on the Kodaikanal-Poombarai bridle path, near Poombarai, is also included.

SECTION 2.—DIVISION OF THE AREA.

513. Generally speaking, the various felling series which go to make up the Fuel Working Circle agree in location and constitution with those brought into existence under the several plans and schemes at present in force. Suitable modifications with reference to the existing growth on them, the improved extraction facilities now available and their artificial regeneration prescribed herein, have however been made. In addition to the existing felling series, new felling series have been formed in localities where local demand has to be met, and some areas from the Timber Working Circle of Mr. Wilson's plan have been transferred to this Working Circle. Certain areas were originally excluded from fuel series under the current plans on account of the poverty of the standing growth, since they were not likely to fetch reasonable prices and since it was considered that their gradual improvement could be better secured by protection and rest than by exploitation not followed by any artificial regeneration. Since this plan prescribes the artifiicial regeneration of felled coupes, such of the areas referred to above as are amenable to any one of the methods of artificial regeneration prescribed herein have been included in this Working Circle.

514. New fuel series have been formed with the primary object of meeting local village demand so as to minimise illicit removals of firewood. It is probable that coupes in such fuel series may not find sales in auction in the immediate future, or regularly every year. All such fuel series have been classified as "Reserve Felling Series."

515. The eastern slopes of the Alagar Hills and the Waguthumalai reserves have been so heavily overworked in the past for fuel, manure leaves, grazing and browsing that the existing growth is generally too poor to find a sale. These areas have been formed into two separate series with the object of regenerating them along with field crops. They will be classified as " Kumri felling series." Other felling series which have been meeting the demands of Madura and the smaller towns of the division regularly will be included under " Commercial felling series." The total number and area of each of these three classes are :—

	Number.	Area.
		ACS.
Commercial felling series	75	159,319
Reserve felling series	9	5,863
Kumri felling series	2	1,975

516. *Ayyalur—Old Vyampatty range.*—The forests of the Kulittalai taluk of the Trichinopoly district (Ayyalur range) were originally constituted into eleven fuel series under Mr. Thornton's Working Plan of 1909. It was observed in 1916–17 that the coupes had been laid out in excess af the prescribed areas and that the areas of reserves adopted in that plan were incorrect. The prescriptions of the plan could not be carried out, in consequence, as the balance of the areas available for fellings was inadequate for the balance of the rotation of 25 years. The plan was therefore revised, the eleven series were clubbed together to form four series and the rotation was raised to 40 years. We are at the end of this rotation for three out of the four series.

These irregularities and the drastic remedy adopted as a temporary make shift have necessitated a complete re-formation of the fuel series in this part of Ayyalur range, with particular reference to the rotation of 30 years which is being proposed under this plan.

The forests here have been allotted to 8 new fuel series, the primary object being the supply of fuel to Madura. Only one of these, the Puthanatham series, is intended for village fuel supply : the remaining seven are " Commercial felling series " which will supply firewood to the Madura market.

517. The subjoined tabular statement compares the proposed Fuel Working Circle with the existing position :—

Existing working.				Proposed working.					
Serial number and name of series.	Area in acres.	Rotation in years.	Average area of coupe in acres.	Serial number and name of series.	Area in acres.	Rotation in years. (interim).	Average area of coupe in acres.	Location.	Classification.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	ACS.		ACS.		ACS.		ACS.		
				SHOLAVANDAN RANGE.					
1 Moruthu	1,350	30	45	1 Moruthu	1,380	30	44	Andipatty Reserve Forest, North.	Commercial series.
2 Andipatty, West..	1,936	30	64	2 Andipatty, West ..	2,085	30	73	Do.	Do.
3 Andipatty, Central.	2,278	30	76	3 Andipatty, Central.	2,325	30	79	Andipatty, Reserve Forest, South.	Do.
4 Andipatty, South.	1,546	30	51	4 Andipatty, South.	1,919	30	71	Do.	Do.
5 Rajadani, North ..	1,850	25	74	5 Rajadani, North	1,919	30	57	Rajadani and Valayapatti Block.	Do.
6 Rajadani, West ..	1,293	25	52	6 Rajadani, West ..	1,416	28	38	Rajadani Block	Do.
7 Vikramangalam, East.	1,530	30	51	7 Vikramangalam, East.	1,655	30	60	Nagamalai-Vikramangalam Block.	Do.
8 Vikramangalam, West.	1,200	25	48	8 Vikramangalam, West.	1,221	26	43	Do.	Do.
9 Waguthumalai ..	2,017	30	67	9 Waguthumalai ..	2,648	30	62	Northern and Western slopes of Waguthumalai.	Do.
10 Sirumalai, South..	2,507	30	83	10 Sirumalai, South..	2,695	30	97	Sirumalai Reserve Forest and Kachaikatti.	Do.
11 Sathiar	1,570	30	52	11 Sathiar	2,111	30	74	Sirumalai Reserve Forest.	Do.
12 Sirumalai, East ..	2,110	30	70	12 Sirumalai, East ..	2,685	30	81	Do.	Do.
13 Anjukulipatty ..	2,020	30	67	13 Anjukulipatty ..	2,238	30	68	Do.	Do.
14 Konapatty ..	1,691	30	56	14 Konapatty ..	1,669	28	60	Do.	Do.
15 Endlaparai ..	1,608	30	54	15 Endlaparai ..	2,284	33	79	Sirumalai, Sirumalai Northern and Western slopes and Sirumalai Northern and Eastern slopes.	Do.
16 Ambathurai ..	1,962	40	49	16 Ambathurai ..	1,836	30	76	Sirumalai Northern and Western slopes.	Do.
17 Sembatti	1,940	30	65	17 Sembatti	2,517	30	89	Sembatti	Do.
				18 Koilpatty ..	830	30	28	Waguthumalai Reserve Forest.	Kumri series.
				NATHAM RANGE.					
1 Perumalai, East ..	1,151	30	38	1 Perumalai, East ..	1,525	30	51	Parts of Perumalai and Papanmalai Blocks.	Commercial series.
2 Mulayur	2,859	30	95	2 Mulayur	2,759	31	89	Parts of Erakalamalai, Perumalai and Papanmalai Blocks.	Do.
3 Chembulimalai ..	1,511	30	50	3 Chembulimalai ..	2,276	30	76	Chembulimalai and Nedumalai Blocks.	Do.
4 Kodavur	2,238	30	75	4 Kadavur	2,536	32	79	Parts of Alagar hill and Kiluvamalai.	Do.
5 Alagarkoil.. ..	1,411	30	46	5 Alagarkoil ..	1,664	30	55	Alagar hill Reserve Forest.	Do.
6 Arukampatty ..	2,139	30	71	6 Arukampatty ..	1,703	30	57	Do.	Do.
7 Kasampatty ..	1,875	30	60	7 Kasampatty ..	1,870	30	62	Do.	Do.
8 Tettampatty ..	1,871	30	62	8 Tettampatty ..	1,851	30	62	Alagar hill and Sanamalai part.	Do.

Existing working. Serial number and name of series.	Area in acres.	Rota-tion in years.	Average area of coupe in acres.	Proposed working. Serial number and name of series.	Area in acres.	Rota-tion in years (interim).	Average area of coupe in acres.	Location.	Classification.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	ACS.		ACS.		ACS.		ACS.		
				NATHAM RANGE—*cont.*					
9 Vemburuli ..	1,503	30	50	9 Vemburuli ..	1,452	30	48	Parts of Alagarhill, Kiluvamalai and Sanamalai blocks.	Commercial series.
10 Pudagudimalai ..	1,902	30	63	10 Pudagudimalai ..	2,062	30	69	Chembulimalai and Nedumalai.	Do.
11 Methugamalai, North.	1,784	30	59	11 Methugamalai, North.	1,632	30	54	Methugamalai part and Chinnapattikaradu.	Do.
12 Methugamalai, South.	1,639	30	55	12 Methugamalai, South.	1,625	30	54	Methugamalai part and Nedunkuttu.	Do.
13 Karumalai ..	1,774	30	69	13 Karumalai ..	1,528	30	51	Karumalai block	Do.
14 Pottapatti ..	1,613	30	54	14 Pottapatti ..	1,593	30	53	Vellimalai-Nedumalai and Valacheripatti hills.	Do.
15 Udupakudi ..	2,499	30	83	15 Udupakudi ..	2,781	32	87	Karandamalai block ..	Do.
16 Karandamalai, East	1,786	30	60	16 Karandamalai, East	2,231	30	74	Do. ..	Do.
17 Karandamalai, West.	2,761	30	92	17 Karandamalai, West.	3,276	32	102	Karandamalai block and Tenkal.	Do.
18 Karandamalai, North.	2,436	30	81	18 Karandamalai, North.	3,069	31	99	Karandamalai block ..	Do.
19 Perumalai ..	1,833	30	61	19 Perumalai ..	2,158	30	72	Parts of Erukalamalai and Perumalai blocks.	Do.
20 Kanavaipatti ..	2,422	30	81	20 Kanavaipatti ..	2,619	30	87	Kuppuravallikuttu and parts of Erakalamalai and Karandamalai.	Do.
21 Kodangikuttu, North.	1,667	30	56	21 Kodangikuttu, North.	1,662	30	55	Kodangikuttu Reserve Forest, part.	Do.
22 Kodangikuttu, South.	1,562	30	52	22 Kodangikuttu, South.	1,562	30	52	Do.	Do.
				23 Periaruvi	1,215	30	41	Alagarhill Reserve Forest.	Do.
				24 Vellalapatti ..	1,145	30	38	Do.	Kumri series.
				AYYALUR RANGE.					
1 Pillayarnatham, North.	2,245	30	75	1 Pillayarnatham, North.	2,247	30	75	Pillayarnathan Reserve Forest.	Commercial series.
2 Pillayarnatham, South.	1,690	30	56	2 Pillayarnatham, South.	1,692	30	56	Do.	Do.
3 Kaluvadimalai ..	2,247	30	75	3 Kaluvadimalai ..	2,244	30	74	Pillayarnatham, Kaluvadi and Panjanthangi Reserve Forests.	Do.
4 Sendurai	1,978	30	66	4 Sendurai	2,281	30	76	Panjanthangi and Mudimali Reserve Forests.	Do.
5 Shorimalai ..	1,749	30	59	5 Shorimalai ..	1,743	30	58	Panjanthangi and Sundamalai Reserve Forests.	Do.
6 Pannamalai ..	2,124	30	71	6 Pannamalai ..	2,128	30	71	Tannirkaradu and Pannamalai Reserve Forests.	Do.
7 Panjanthangi ..	1,609	30	54	7 Panjanthangi ..	1,604	30	53	Panjanthangi and Sundamalai Reserve Forests.	Do.
8 A. Kombai ..	2,142	30	71	8 A. Kombai ..	2,144	30	71	Panjanthangi Reserve Forest.	Do.
9 Mudimalai ..	1,730	30	58	9 Mudimalai ..	1,789	30	60	Mudimalai Reserve Forest	Do.
10 Thopaswamimalai, north.	2,152	30	72	10 Thopaswamimalai, North.	2,152	30	72	Thopaswamimalai Reserve Forest.	Do.
11 Thopaswamimalai, Central.	2,530	30	84	11 Thopaswamimalai, Central.	2,850	30	95	Do.	Do.
12 Thopaswamimalai, South.	2,475	30	83	12 Thopaswamimalai, South.	2,518	30	84	Do.	Do.
13 Mungilkaradu ..	1,756	30	58	13 Mungilkaradu ..	1,754	30	58	Mungilkaradu Reserve Forest.	Do.
14 Viramalai	5,752	The rotation and average area of these series varied owing to clubbing together of the series.		14 Viramalai, West ..	3,278	30	109	Viramalai, Naganur and Aniyapur blocks.	Do.
15 Karpur Reddiapatti.	6,650			15 Viramalai, East ..	3,246	30	108	Do.	Do.
16 Sorupam	3,203			16 Kumarikatti ..	3,778	30	126	Karpur Reddiapatti part and Kumarikatti.	Do.
17 Semmalai .. .	4,793			17 Karpur Reddiapatti	2,683	30	89	Karpur Reddiapatti part and Poigamalai.	Do.
				18 Sorupam	3,184	30	106	Panjanthangi hill, Valley and Sorupam.	Do.
				19 Semmalai	3,099	30	103	Semmalai part, Methalamalai, Sigamkaradu, Pakkirkaradu and Minnakaradu.	Do. Do.
				20 Mogavanur ..	2,990	30	100	Semmalai part and Mogavanur.	Do.
				21 Puthanatham ..	684	30	23	Puthanatham Reserve Forest.	Reserve series.
				KODAIKANAL RANGE.					
1 Agamalai	621	..	20	1 Agamalai	621	30	22	Alinagaram Reserve Forest.	Commercial series.
2 Amburuvi ..	1,380	30	46	2 Amburuvi ..	1,693	30	60	Palni Hills Southern Slopes West Reserve Forest, Amburuvi.	Do.
3 Pambar	1,440	30	48	3 Pambar	1,968	32	67	Do.	Do.
4 Adukkam ..	1,410	30	47	4 Adukkam ..	1,570	30	52	Palni Hills Southern Slopes West Reserve Forest. Amburuvi and Murugamalai Reserve Forest.	Do.
5 Murugamalai ..	1,200	40	30	5 Murugamalai ..	1,084	30	41	Murugamalai Reserve Forest.	Do.
6 Iruttar	1,320	40	33	6 Iruttar	1,313	30	52	Palni Hills Southern Slopes East Reserve Forest.	Do.
7 Sadayaperumal ..	1,120	40	28	7 Sadayaperumal ..	1,102	30	43	Do.	Do.
8 Mankaradu ..	1,320	40	33	8 Mankaradu ..	1,130	30	39	Do.	Do.
				9 Poombarai ..	19	10	1·9	Gundar Valley Extension Reserve Forest.	Reserve series.
				10 Gundan Shola, East.	115·7	30	3·9	Do.	Do.
				11 Gundan Shola, West.	135	30	4·5	Do.	Do.

Existing working.				Proposed working.					
Serial number and name of series.	Area in acres.	Rota- tion in years.	Average area of coupe in acres.	Serial number and name of series.	Area in acres.	Rota- tion in years (interim).	Average area of coupe in acres.	Location.	Classification.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	ACS.		ACS.		ACS.		ACS.		
				PALNI RANGE.					
1 Palni	1,580	30	53	1 Palni	1,978	30	65	P.V. Valley and Karadi-kuttu Reserve Forests.	Commercial series.
2 Virupakshi ..	1,780	30	60	2 Virupakshi, South.	2,560	31	85	Northern Slopes Reserve Forest.	Do.
				3 Virupakshi, North.	860	30	29	Do.	Reserve series.
				4 Chatrapatti ..	860	30	29	Vennilai Reserve Forest	Do.
				5 Athikombai ..	634	30	21	Northern slopes Reserve Forest.	Do.
				6 Ayyampalayam ..	580	30	19	Marudanadiar Reserve Forest.	Do.
				CUMBUM RANGE.					
1 Kombai	908	30	33	1 Kombai	1,471	30	49	Kombai Reserve Forest.	Commercial series.
2 Pudupatti ..	1,360	30	45	2 Pudupatti ..	1,603	30	53	Kombai Reserve Forest and Pannimuthankaradu.	Do.
3 Machakkal ..	1,880	30	60	3 Machakkal ..	1,770	30	59	Kombai and Machakkal ..	Do.
4 Suranganar ..	1,950	30	65	4 Suranganar ..	2,328	30	81	Suranganar, Keelagudalur and Vannathiparai.	Do.
5 Surulipatti ..	1,652	30	55	5 Surulipatti ..	2,402	30	80	Buthakaradu, Puvathuka-radu, Dhonikaradu and Surulipatti.	Do.
				6 Vannathiparai ..	2,075	30	69	Kappuvamadai, Butha-karadu and Vannathi-parai.	Reserve series.

SECTION 3.—ANALYSIS AND VALUATION OF THE CROP.

518. At the time when Mr. Wilson's plan for the Natham, Sholavandan and Ayyalur (excepting Kulitalai taluk) ranges was prepared in 1916, stockmaps of all the reserves in these three ranges were prepared, showing the density of stocking, the stand per acre in tons of fuel outturn, and the important prevailing species. These stockmaps were revised for the purpose of this plan and, in addition, stockmaps of all the fuel felling series in other parts of the division were prepared on the same lines. They exhibit the most important prevailing species over the fuel areas, arranged in the order of their occurrence, together with an eye estimate of the probable fuel outturn in tons of wood per acre. The estimates of probable outturn were based on indicator areas under felling, past outturn figures, contractor's figures for coupes under felling, and actual counting and measurement of stacks in felled coupes. The enumeration of sample plots in coupes of known age for the purpose of fixing the rotation was useful in arriving at an estimate of the number of stems standing per acre. The stockmaps, combined with the number of stems per acre, will, it is hoped, make it possible to visualise the present condition of the crop in the various felling series and to compare it with that which will prevail ten years later when this plan comes up for revision.

519. The subjoined statement gives a brief description of the growth in each felling series (containing information on the number of stems per acre, the general condition of the crop, the undergrowth and any peculiarities of the soil, which are not shown on the stockmaps), regeneration methods and species recommended, extraction facilities, etc.

Description of Felling Series.

Serial number and name of felling series.	General description of stock.	System and species recommended for regeneration.	Extraction facilities existing and proposed.
	SHOLAVANDAN RANGE.		
1 Moruthu	Upper slopes full of *Moringa* and thick *Barleria*. Illicit fellings rife. Average number of stems about 175 per acre.	Rab sowings of *Acacia planifrons, Acacia latronum* and *Albizzia lebbek*.	Produce generally converted into charcoal or removed in head-loads.
2 Andipatti, West ..	Undergrowth—*Barleria* and *Acalypha*. Illicit fellings rife. Average number of stems per acre about 175.	Rab sowings. *Acacia planifrons* specially recommended.	Cart-tracks exist from the coupe to the metalled road. Produce removed in cart-loads and head-loads.
3 Andipatti, Central ..	Undergrowth—*Barleria*, grass and *Pterolobium*. Average number of stems per acre 200.	Rab sowings. *Acacia planifrons, Acacia latronum* and *Albizzia lebbek*.	Do.
4 Andipatti, South ..	Undergrowth—*Barleria, Acalypha* and grass. There are many over-mature Usil in old coupes XVII—XIX. Average stems per acre 225.	Rab sowings. *Albizzia amara, Acacia planifrons* and *Acacia latronum*.	Do.
5 Rajadhani, North ..	Undergrowth—*Dodonoea viscosa, Acalypha* and grass. Plenty of *Euphorbia*. Soil rocky. Average stems per acre 225.	Rab sowings. *Acacia planifrons* specially recommended.	Cart-tracks leading to forest road are easily made.
6 Rajadhani, West ..	Composition similar to North series, [illegible]se. Average stems per acre 200.	Rab sowings. *Acacia planifrons* specially recommended.	Cart-tracks leading to forest are easily made.

Serial number and name of felling series.	General description of stock.	System and species recommended for regeneration.	Extraction facilities existing and proposed.
SHOLAVANDAN RANGE—*cont.*			
7 Vikramangalam, East..	Undergrowth—*Barleria*, *Cassia auriculata* and grass. Illicit fellings common. Soil in most places rocky. Average stems per acre 200.	Rab sowings. *Acacia planifrons*, *Acacia latronum*, *Albizzia lebbek*, *Azadirachta indica*.	Produce removed mostly by head-loads and partly by carts. A rough cart-track leads to Sholavandan.
8 Vikramangalam, West.	Composition similar to East series. Illicit fellings slightly less than in the former. More *Albizzia amara* found in the southern block. Average stems per acre 200.	Do.	Do.
9 Waguthumalai ..	Undergrowth—Grass mostly, *Barleria* and *Pterolobium*. Southern slopes unfit for fuel series, hence included in Kumri series. Northern slope average stems per acre 150.	Do.	Produce removed in cart-loads and head-loads. Andipatti-Palamedu forest road serves the series.
10 Sembatti	Undergrowth—*Dodonoea viscosa*, *Cassia auriculata* and grass. Stems per acre about 200.	Rab sowings. *Acacia planifrons*, *Acacia latronum*, *A. ferruginea*, *Albizzia lebbek*, *Azardirachta indica*.	Produce removed mostly in cart-loads. Palamedu-Andipatti road and Sathiar road serve the series.
11 Sirumalai, South ..	Undergrowth—Grass, *Barleria* and *Acalypha*. Average stems per acre 250.	Rab sowings. *Acacia planifrons*, *Acacia latronum*, *A. ferruginea*, *Albizzia amara*.	Produce removed in cart-loads and head-loads. Palamedu-Andipatti road and Sathiar road serve this series, through cart-tracks.
12 Sathiar	Undergrowth—*Barleria*, *Acalypha*, *Acacia intsia* and grass. Natural sandal patch of 80 acres in the centre of the series. Stems about 250 per acre.	Do.	Produce removed in cart-loads. Sathiar forest road runs through the entire series.
13 Sirumalai East ..	Undergrowth grass, *Acacia intsia*, *Pterolobium*, *Barleria*. Average stems per acre about 250.	Do.	Produce removed mostly by cart-loads, the Palamedu-Valayapat cart-track being the main route. Proposal to get a road made from Palamedu to Valayapatti by the District Board has been made in the plan.
14 Endlaparai	Undergrowth—*Barleria*, *Pterolobium*, *Acacia intsia* and grass. Sandal has a strong hold in the series. Stems per acre average 225.	Rab sowings. *Acacia planifrons*, *Acacia latronum*, *Acacia leucopholea*, *Acacia ferruginea*.	Produce removed both by cart-loads and head-loads. Connected by temporary cart-tracks to the Dindigul—Sirumalai and Dindigul Natham road.
15 Anjukulipatti	Undergrowth—*Acalypha*, *Barleria*, *Helecteris isora*, *Acacia intsia*, *Pterolobium indicum* and grass. Stems per acre average 300.	Rab sowings. *Acacia planifrons*, *Acacia ferruginea*, *Albizzia lebbek*, *Azadirachta indica*.	Produce removed in cart-loads only. Anjukulipatti-Valayapatti forest road adjoins most coupes. Improvements to zigs in the road are proposed to facilitate transport to Madura via Palamedu.
16 Konapatti	Undergrowth—*Barleria*, *Pterolobium* and grass. Average stems per acre 275.	Do.	Konapatti road and the Tavasimadai road cum cart-track serve the series. Connecting up the Konapatti road to Emakalapuram is proposed.
17 Ambathurai	Undergrowth—Thick *Barleria* in the centre, *Carissa spinarum* in flat bits and grass on the slopes. Illicit fellings rife. Stems about 200 per acre.	Species same as above and half the area is suited for Kumri.	Produce removed in head-loads mostly and consumed locally.
18 Koilpatti (Kumri) ..	Poorly stocked or no growth at all.	Area suited for Kumri; species as above.	....
NATHAM RANGE.			
1 Perumalai, East ..	About 200 stems per acre. Undergrowth *Acalypha fructicosa*, *Dodonoea viscosa*, *Barleria* and *Clausena*.	Rab and Kumri sowing of *Acacia planifrons*, *Acacia latronum*, *Albizzia amara*.	Madura-Natham road close to the series.
2 Mulaiyur	About 250 stems per acre; undergrowth *Acalypha fruticosa*, *Dodonoea viscosa*, *Randia* and *Clausena*.	Rab sowing of *Albizzia amara* *Acacia latronum*, *Acacia planifrons* and *Acacia ferruginea* and Kumri cultivation.	Valayapatti-Dindigul-Natham road.
3 Perumalai	About 250 stems per acre; undergrowth *Acalypha fruticosa*, *Dodonoea*, *Acacia intsia* and *Barleria*.	Rab sowings of *Acacia latronum*, *A. planifrons*, *Acacia ferruginea* and *Albizzia amara*.	Mulaiyur-Valayapatti and Madura Natham roads.
4 Chembulimalai ..	About 200 stems in southern slopes and barely above 100 stems in the northern slopes; undergrowth *Fluggea microcarpa*, *Dodonaea viscosa*, *Clausena* and *Acalypha fruticosa*.	Rab sowing as above	Natham-Madura and Natham-Kottampatti roads.
5 Kadavur	*Acacia sundra* generally found; number of stems about 175 per acre; undergrowth *Dodonoea viscosa* and *Acalypha fruticosa* in the lower slopes and *Barleria* in the higher slopes.	Intensive regeneration necessary near Kadavur by rab sowing of *Albizzia lebbek*, *Albizzia amara*, *Acacia latronum*, *Acacia planifrons*, *Wrightia tinctoria* and *Acacia sundra*.	Madura-Natham road.
6 Alagarkoil	Stock generally poor in the western portion; average about 200 stems per acre; undergrowth *Acalypha fruticosa*, *Dodonoea viscosa* and *Barleria*.	Rab sowing of *Albizzia amara*, *Acacia latronum*, *Acacia planifrons*, *Wrightia tinctoria* and *Azadirachta indica*.	Both the Minnur and Alagar Ghat roads serve to remove the produce.
7 Arukkampatti	Stock generally poor and is of a scrub jungle type. About 200 stems per acre. Undergrowth *Acalypha fruticosa*, *Dodonoea viscosa*, *Webera corymbosa*.	Rab sowing of *Acacia planifrons*, *Albizzia lebbek*, *Acacia latronum*, *Albizzia amara* and *Tectona grandis*.	Arukkampatti forest road and the cart-tracks to the main road via Pulipatti and Valayapatti.
8 Kasampatti	Stock poor. About 175 stems per acre; a few *Tectona grandis*, *Hardwickia binata* are met with. Undergrowth *Acalypha fruticosa*, *Randia* and *Dodonoea viscosa*. Higher slopes are grassy.	Rab sowing of *Albizzia amara*, *Acacia planifrons*, etc.	There is a good ghat road connecting with the main road to Madura.
9 Tethampatti	Stock poor along the boundary. Stems about 175 per acre in poor localities and about 275 per acre in other areas. Undergrowth *Webera corymbosa*, *Acalypha fruticosa* and *Dodonoea viscosa*, etc.	Rab sowing of *Albizzia lebbek*, *Acacia latronum*, *Wrightia tinctoria* and *A. planifrons*.	Branch road from Perumalpatti connects with the series and leads to Madura-Natham road from Perumalpatti.

NATHAM RANGE—*cont.*

Serial number and name of felling series.	General description of stock.	System and species recommended for regeneration.	Extraction facilities existing and proposed.
10 Vemburuli	About 200 stems per acre. *Euphorbia* is prominent throughout and other undergrowths are *Barleria, Acalypha fruticosa, Dodonoea viscosa*, etc.	Rab sowing of *Acacia planifrons, Acacia latronum, Albizzia amara*, etc.	Natham-Madura road is within half a mile of the series.
11 Pudagudimalai ..	About 200 stems per acre. Undergrowth *Acalypha fruticosa, Dodonoea viscosa, Clausena, Cassia auriculata*, etc.	Rab sowings of *Acacia planifrons, Albizzia amara, Acacia latronum*, etc.	Vallalapatti cart-track and Natham-Kottampatti road.
12 Methugamalai, North ..	About 225 stems per acre. Not much of undergrowth except *Randia*.	Rab sowing as above	Natham-Kottampatti via Sirugudi and Natham Thovaram-kurichi via Kurumbapatti.
13 Methugamalai, South ..	About 225 stems per acre. Undergrowth *Randia, Dodonoea viscosa, Acalypha fruticosa*, etc.	Rab sowing of *Albizzia amara, Acacia planifrons, Acacia latronum, Acacia ferruginea* and *Wrightia tinctoria*.	Both Kuttupatti-Natham road and Sirugudi road via Natham serve the series.
14 Karumalai	About 250 stems per acre. Undergrowth *Acalypha fruticosa, Webera corymbosa, Clausena. Dodonoea viscosa*, etc.	Rab sowing as above	Difficult for direct transport and so a route from Vellimalai to Sirugudi is necessary. Acquisition proposed.
15 Pottapatti	About 300 stems per acre. *Anona squamosa* in Valacheripatti hills. Undergrowth *Clausena, Acalypha fruticosa, Dodonoea viscosa* etc.	Do.	Kottampatti road serves Valacheripatti hills and an extension of the Vellimalai road up to Pottapatti is necessary.
16 Udupagudi	About 200 stems per acre. Undergrowth *Dodonoea viscosa Acalypha fruticosa* and *Clausena* in the lower slopes and *Barleria* in the higher slopes.	Kumri and Rab sowing of *Albizzia amara, Acacia planifrons, Acacia latronum* and *Wrightia tinctoria*.	Good cart-track connects Dindigul-Natham-Madura road.
17 Karandamalai, East ..	About 300 stems per acre. Undergrowth *Acalypha fruticosa, Cassia auriculata, Dodonoea viscosa*, etc.	Kumri and Rab sowing as above.	Natham-Manakattur road is close to the series.
18 Karandamalai, North..	The average number of stems per acre varies from 250 to 400. Undergrowth *Euphorbia, Clausena, Acalypha fruticosa* and *Barleria*, etc.	Rab sowing of *Albizzia amara, Acacia latronum, Acacia ferruginea and Wrightia tinctoria* in the hill slopes and *Albizzia lebbek* in the flat area, north of Iyankodai.	Senkurichi-Manakattur and Iyankodai roads.
19 Karandamalai, West ..	Stock poor in the northern potion, about 250 stems per acre; undergrowth *Acalypha fruticosa, Barleria* and *Clausena*, etc.	Rab sowing of *Albizzia amara, Acacia ferruginea, Acacia latronum, Acacia planifrons, Wrightia tinctoria* and *Zizyphus trinerva*.	Kanavoipatti-Senkurichi road.
20 Kanavoipatti	About 300 stems per acre. Undergrowth *Acalypha fruticosa, Clausena* and *Barleria*, etc.	Rab sowing of *Albizzia amara, Acacia ferruginea, Acacia, latronum, Acacia planifrons, Wrightia tinctoria*.	Dindigul-Natham road and forest roads from Kanavoipatti to Valayapatti and Senkurichi serve the series.
21 Kodangikuttu, North..	About 300 stems per acre. *Hemicyclia sepiaria* prominent in upper slopes. Undergrowth as above.	Rab sowing as above	Senkurichi-Sendurai road easily accessible.
22 Kodangikuttu, South ..	About 300 stems per acre, well stocked. *Hemicyclia sepiaria* largely predominant.	Rab sowing as above	Within easy reach of Sengurichi-Manakattur road.
23 Periaruvi	About 250 stems per acre. There is a bamboo area in the middle of the series. Undergrowth *Acalypha fruticosa, Dodonoea viscosa*, etc.	Rab sowing as above	A cart-track from Alagarkoil joins the Arukkampatti-Vemburuli road. Repairs to ghat section proposed.
24 Vallalapatti (Kumri) ..	Generally poor growth. Stems vary from 100 to 150 per acre. Undergrowth *Dodonoea viscosa, Randia*, etc.	Kumri cultivation	Extraction roads poor. Country tracks exist, but there is very little to remove.

AYYALUR RANGE.

Serial number and name of felling series.	General description of stock.	System and species recommended.	Extraction facilities existing and proposed.	Remarks.
Pillayarnatham, North.	Stock variable. About 200 stems per acre. Undergrowth *Acalypha fruticosa* thick in the lower slopes and mixed with *Clausena* and *Stenosiphonium* and in upper slopes *Barleria*.	Rab sowing of *Acacia planifrons, Albizzia amara, Albizzia lebbek* and *Chloroxylon swietenia*.	Pillayarnatham-Kalpatti, Pillayarnatham-Sendurai and Pillayarnatham-A. Kombai roads.	A well at Chem banuthu is proposed.
2 Pillayarnatham, South.	About 200 stems per acre. Undergrowth same as above.	Do.	Do.	
3 Kaluvadimalai ..	Stock poor in the eastern portion. About 175 stems per acre. Undergrowth *Acalypha fruticosa, Clausena, Barleria, Acacia intsia*, grass, etc.	Rab sowing as above ..	Sendurai-Ayyalur road, Pillayarnatham–Sendurai road and Sendurai–Senkurichi-Ayyalur road.	Repairs to the well inside the reserve forest near Alangagoundanpatti is proposed.
4 Sendurai	Stems about 200 per acre. Undergrowth as above but with grass in the higher regions.	Do. ..	Do.	
5 Mudimalai	Average stems about 175 per acre. Top portion grassy with patches of growth containing small timber. Undergrowth as above.	Do. ..	Sendurai-Ayyalur, Senkurichi-Vadamadurai and Sendurai-Senkurichi roads.	
6 Shorimalai	About 200 stems per acre. Undergrowth *Acalypha fruticosa* very thick in the lower areas and mixed with *Clausena* and *Barleria* in the higher slopes.	Rab sowing as above and Kumri in the lower regions.	Sengurichi-Ayyalur road and cart-tracks.	
7 Panjanthangi ..	Undergrowth as above. Stems about 200 per acre.	Rab sowing as above ..	Sendurai-Ayyalur road and cart-tracks.	
8 A. Kombai	Do.	Rab sowing as above and Kumri.	Sendurai-Ayyalur road and Pillayarnatham-A. Kombai road.	
9 Pannamalai	About 175 stems per acre. Illicit fellings rampant in the western portion. Undergrowth as above.	Extensive regeneration by rab sowing as above and Kumri in the lower regions.	Sengurichi-Ayyalur road and Sengurichi-Vadamadurai road and cart-tracks.	
10 Mungilkaradu ..	Average about 175 stems per acre. Undergrowth as above.	Do.	Mungilkaradu-Ayyalur road and cart-tracks.	
11 Thoppaswamimalai, North.	Average about 150 stems per acre. Illicit fellings rife. Undergrowth *Barleria, Acalypha fruticosa, Euphorbia' Scutea indica* and grass.	Rab sowing as above ..	Extraction facility poor and so fuel is converted to charcoal and removed by head-loads to R. Kombai-Karuttapatti road.	

Serial number and name of felling series.	General description of stock.	System and species recommended.	Extraction facilities existing and proposed.	Remarks.
		AYYALUR RANGE—*cont.*		
12 Thoppaswamimalai, Central.	Average about 150 stems per acre. Illicit fellings rife. Undergrowth *Barleria, Acalypha fruticosa, Euphorbia, Scutea indica* and grass. Top portion grassy and rocky.	Rab sowing as above and Kumri in lower places.	R. Kombai-Karuttapatti road meets Dindigul-Karur road and Eriode-Ayyalur-Vadamadurai road.	
13 Thoppaswamimalai, South.	Do.	Do.	Cart-tracks and Ayyalur-Malapatti road.	
14 Viramalai, West ..	Average about 175 stems per acre. Undergrowth as above.	Rab sowing of *Acacia planifrons, Acacia leucophloea, Albizzia amara* and *Chloroxylon swietenia.*	Pottapatti-Pusaripatti forest road and Manaparai-Kulitalai road.	
15 Viramaiai, East ..	Do.	Do.	Do.	
16 Surpam	About 200 stems per acre. Undergrowth as above.	Rab sowing as above with the addition of *Albizzia lebbek* and Kumri regeneration.	Pillayarnatham-Kalpatti road and Kalpatti-Puthanatham cart-track ; the latter is proposed to be converted into a good road.	
17 Kumarikatti ..	Do.	Rab sowing as above ..	Vyampatti-Kadapichampatti road and Kalpatti-Puthanatham cart track and Puthanatham-Manaparai road.	
18 Karpur-Reddiapatti series.	150 to 200 stems per acre. Undergrowth *Acalypha fruticosa, Dodonaea viscosa* and *Euphorbia.*	Rab sowing of *Albizzia amara, Acacia planifrons, Melia indica.* Kumri in Poigamalai.	Vyampatti-Kadapichampatti road and Kalpatti-Puthanatham cart-track.	
19 Mogavanur	Stock poor in the top portion of Semmalai reserve forest. About 175 stems per acre. Undergrowth as above.	Rab sowing as above. Kumri in Mogavanur reserve forest.	Kadavur-Vyampatti road and Ayyalur-Vyampatti road.	
20 Semmalai	Do.	Rab sowing as above ..	Kalpatti-Ayyalur road, Kalpatti-Puthanatham cart-track and Kalpatti-Pillayarnatham road.	
21 Puthanatham ..	About 200 stems per acre. Undergrowth as above.	Regeneration by Kumri and Rab as above.	Puthanatham-Marungapuri road and Puthanatham-Manaparai road.	
		CUMBUM RANGE.		
1 Kombai series.	Stock about 220 stems per acre. Coppice growth mostly mutilated by illicit feelling. A higher percentage of *Protium caudatum.* Undergrowth *Acacia intsia* in flat bits and *Acalypha* all along the boundary.	Rab sowing throughout. *Acacia planifrons* specially suited. *Albizzia lebbek* and *Albizzia odoratissima* in valleys and banks.	Produce removed only by head loads.	Two pens proposed above fuel series limit.
2 Pudupatti series.	Stock in southern half 220 per acre. Undergrowth *Barleria* and *Acalypha. Protium caudatum* 50 per cent. Northern portion poorer stock, *Protium* 30 per cent.	Rab. *Acacia planifrons* generally recommended.	Do.	
3 Machakal	Stock 200 stems per acre in lower slopes and over 300 in upper slopes. Large blanks in old coupes I to VI 50 per cent. *Bambusa arundinacea* in old coupes XX and XXI. Grass in upper slopes and dense *lantana* all along the outer boundary.	Rab. *Albizzia lebbek, Albizzia odaratissima* and *Stereospermum chelonoides* for lower slopes only.	Suitable cart-tracks serve the series.	
4 Suranganar	Stock 250 stems per acre in lower portions and over 300 on slopes. *Anogeissus latifolia* 50 per cent of the stock on hill slopes. Good distribution of timber species. Patches of *Bambusa arundanacea* found in the series. Soft woods 10 per cent. *Acacia intsia* and lantana, very dense in flat portions.	Rab generally recommended. *Melia dubia, Albizzia lebbek* and *Albizzia odoratissima* in Suranganar valley.	Suitable cart-tracks connecting up the series to the main road exist.	
5 Vannathiparai ..	Stock 150 stems per acre in Kappavamadai. 180 in Vannathiparai flat bits and over 250 on hill slopes. Undergrowth of *Acacia intsia* and some lantana are found throughout the series.	Kumri recommended in Kappavamadai and flat portions of Vannathiparai. *Acacia planiforns, Acacia latronum* and *Acacia leucopholea* for Kappavamadai and *Albizzia lebbek* and *Dolichandrone falcata* for other places.	Extension of Cumbum-Surulipatti road will facilitate work in the series in addition to the Vannathiparai road.	Pen proposed at Venniarthoiluvu above the fuel limit.
6 Surulipatti	Stock 250 stems per acre on hill slopes and 200 in areas close to lower boundary. Good growth of *Eugenia* and *Mangifera* along perennial streams. Vekkali 60 per cent of stock. Soft wood 20 per cent. Hill slope entirely grassy.	Rab generally recommended.	Several rough cart-tracks exist ..	Pen proposed above fuel series limit between Anaigajam and Ambugajam streams.
		PALNI RANGE.		
1 Virupakshi, South ..	Stock 200 to 280 stems per acre. Undergrowth *Acalypha* generally and lantana dense round about Vadakadu. Soft woods 25 per cent.	Rab generally recommended. Round Parapal in abandoned cultivation. Kumri possible. *Albizzia lebbek, Albizzia odoratissima* and *Acacia planifrons.*	Extension of Oddanchatram-Vadakadu road into Parapal plateau is proposed.	Facilities for grazing exist.
2 Chatrapatti	Stand 220 stems per acre on an average. Undergrowth *Acalypha, Barleria* and a little *lantana.*	Rab generally. *Acacia planifrons, Acacia latronum* and *Albizzia lebbek.*	Produce will be removed chiefly in head-loads.	The reserve forest is closed to grazing.
3 Virupakshi, North ..	Stand less than 200 stems per acre. Undergrowth *Acalypha, Pterolobium indicum* and *Barleria Protium caudatim* 25 per cent of the stock.	Rab. *Acacia planifrons* specially suitable.	Do.	Suitable area outside the series is available for grazing.
4 Athikombai	Stand 120–150 stems per acre. Softwood 20 per cent. *Pterolobium indicum* and *Acacia intsia* very dense.	Rab. *Acacia planifrons* recommended.	Carts can be taken if need be along existing. Cart-tracks.	Do.

Serial number and name of felling series.	General description of stock.	System and species recommended.	Extraction facilities existing and proposed.	Remarks.
		PALNI RANGE—*cont.*		
5 Ayyampalayam ..	Stand varies from 150 to 250 stems per acre. Over-mature *Albizzia amara* found throughout the series. Undergrowth *Acalypha* and *Pterolobium indicum*.	Rab in hill slopes and Kumri in flat bits. *Albizzia amara, Albizzia lebbek, Acacia planifrons.*	Produce to go in head-loads. A cart-track connecting up the series to Ayyampalayam exists.	
6 Palni	Stand 150 to 200 stems per acre. *Mangifera* found all along the two rivers. Soft wood 50 per cent. *Protium caudatim, Gyrocarpus jacqunni, Euphorbia* and *Acacia intsia* found throughout.	Rab. Same species as above.	Produce at present removed only in head-loads. Conversion of the Municipal pipe line into a pucca road is suggested.	
		KODAIKANAL RANGE.		
1 Adukkam	Undergrowth—*Acalypha, Pterolobium indicum* and grass. Average number of stems per acre 200.	Rab sowings. *Acacia planifrons, Acacia latronum* and *Albizzia amara.*	Produce removed by head-loads and cart-loads. Rough cart-tracks exist and part of the metalled road to the Tope serves the series.	
2 Amburuvi	Undergrowth—*Barleria, Acalypha, Acacia intsia* and grass. Average number of stems about 200 per acre.	Do.	Produce removed by head-loads and cart-loads. Rough cart-tracks and the water-works road serve the series.	
3 Pambar	Undergrowth—*Barleria, Pterolobium indicum, Acalypha* and grass. Average stems per acre 275.	Rab sowings. *Albizzia odoratissima, Acacia planifrons, Acacia latronum* and *Acacia ferruginea.*	Head-loads and cart-loads. Rough cart-tracks and the road to Tope serve the series.	
4 Iruttar	Undergrowth—*Barleria, Acalypha,* grass, *Phoenix acaulis, Pterolobium indicum.* Plenty of *Albizzia lebbek* in old coupe XI. Number of stems per acre 250.	Rab sowings, *Acacia planifrons* in grassy areas and *Albizzia lebbek* in plains.	Produce removed in head-loads and cart-loads. Iruttar road and roug' cart-tracks serve the series.	**Irrigated teak plantation proposed in the valley.**
5 Sadayaperumal ..	Undergrowth—*Barleria* and grass. Average stems per acre 175.	Rab sowings of *Acacia planifrons, Acacia latronum* and *Azadirachta indica.*	Produce removed in head-loads and and cart-loads. Kodaikanal ghat road connecting Vatalakundu-Periyakulam road serves the series.	
6 Murugamalai ..	Undergrowth—*Barleria, Carissa spinorum* and grass. Fine poles of *Anogeisus latifolia* found on the plateau. Average stems per acre 225.	Rab sowings of *Acacia planifrons, Acacia latronum* and *Azadiracta indica.*	Head-loads and cart-loads. Devadanapatti road serves this series.	
7 Mankaradu	Undergrowth—*Barleria* and grass. Degraded type of forest. Stems per acre 150.	Rab sowings, on a large scale, of *Acacia planifrons* and *Acacia latronum.*	Produce removed in head-loads and cart loads. Batlagundu-Kanavoipatty road serves this series.	
8. Agamalai	Undergrowth—*Acalypha, Barleria, Pterolobium indicum, Acacia intsia, Zizyphus oenoplia* and grass.	Rab sowings of *Acacia planifrons, Acacia latronum, Albizzia lebbek, Azadirachta indica.*	Produce removed in head-loads and cart-loads. Rough cart-tracks to Teni exist.	

SECTION 4.—METHOD OF TREATMENT.

520. The method of treatment proposed is the "Simple Coppice" system, but it is prescribed that tamarind, *Terminalia chebula* and sandal shall not be felled when found inside the coupe provided that the District Forest Officer may, after personal inspection or on the report of his gazetted assistant, authorise the felling of old or unsound trees of tamarind which have ceased to bear or which are not likely to survive for another rotation. The reservation of tamarind and sandal is current practice and will be continued since their value as producers of minor produce is greater than their fuel value. In addition to sandal and tamarind, no *Schleichera trijuga* shall be felled in the Suranganar and Vannathiparai felling series of Cumbum range, when found inside the coupe. These felling series adjoin the Vannathiparai lac farm and it is desirable to provide for any possible extension of lac cultivation in the locality by reserving all available host trees in the neighbourhood.

521. Under the existing system of management, all fuel felling series, with the exception of those confined to Cumbum range, are being worked under the "Simple Coppice" system. In the Cumbum range, however, the working plan sanctioned in B.P. No. 2 of 3rd January 1912, prescribed the "Coppice with Standards" system on a rotation of 30 years. This was in force up to 1932–33. In the year 1933–34, the Suranganar series progressed into the second rotation. An examination of the standards reserved in the first rotation in this series, as well as in other series, still under the first rotation revealed that many of the best stems belonging to timber species had been illicitly removed. The main object with which this particular treatment had been prescribed had thus been largely frustrated.

This working plan prescribes the formation of a "Selection Working Circle" in the Cumbum range for meeting legitimate demands for timber and the clear-felling of timber areas prior to their being planted up with teak under the "Clear-felling Working Circle". These provisions will secure the subsidiary object which the "Coppice with Standards" system has failed to realise. "The Simple Coppice" system is more suited to the attainment of the main object of management, viz., fuel production, than the "Coppice with Standards" system. It will also result in complete uniformity in the management of the various fuel forests of the division. The "Simple Coppice" system will therefore be adopted for the fuel series of the Cumbum range also. In fact, the change has already been effected from the year 1934.

522. *Rotation.*—Precise data for the accurate calculation of the financial rotation for mixed deciduous forests of varying qualities worked under the simple coppice system are almost impossible of collection, under existing conditions. An attempt has however been made to obtain an indication as to the period of rotation beyond which it would be undesirable, in this division, to allow the coppice to remain unexploited.

523. For this purpose sample plots were laid out in a large number of coupes of known age in the Sholavandan Natham and Ayyalur ranges, the ranges most important as producers of fuel for the Madura market. These sample plots varied in extent from 0·4 acres to 5·4 acres and covered localities of all qualities and crops from 15—32 years of age. The girths, at breast height, of coppice shoots of important fuel species were then measured and the results recorded. The number of plots measured were 50 in Sholavandan, 31 in Natham and 25 in Ayyalur.

Since *Albizzia amara* is the species that prevails predominantly in these three ranges and since it is one of the species for which there is a steady demand, it was decided to base our conclusions on data collected for that species.

524. The girth measurements for coppice shoots of *Albizzia amara* were plotted against their respective ages, the data for each range being dealt with separately.

Mean curves were then drawn showing the Current Annual Increment in girth in the three ranges dealt with. The Mean Annual Increments were then calculated from the curves for the Current Annual Increment and curves showing the former were superimposed on the Current Annual Increment curves.

525. The rotation of " maximum " volume production is given by the culminating point of the curve for the Mean Annual Increment which coincides with the point where the Mean Annual Increment is equal to the Current Annual Increment.

The curves indicate that this point is at 16, 17 and 28 years of age for the Sholavandan, Natham and Ayyalur ranges, respectively.

526. These tentative conclusions have to be modified with reference to the following facts :—

(1) Of the sample plots taken up for measurement, those up to 17 years of age were in areas under Simple Coppice, but those above that age were under Coppice with Standards, as the latter system prevailed exclusively before 1917. It is reasonable to expect a more rapid rate of increment under " Simple Coppice " than under Coppice with Standards and culmination point at a somewhat later age ;

(2) the dispersal of points on the Current Annual Increment curves is so great that no *precise* figure for the best rotation can be deduced from them.

527. It is, however, obvious that the relation between price increment and girth is one of the prime factors that has to be taken into consideration in fixing the rotation of fuel series. It is also clear that we stand to lose in allowing trees to grow up to girths much above the minimum in demand mainly because of the fall in the rate of girth increment not being compensated for by a corresponding increase in price.

An examination of the billets offered for sale at Madura shows a preponderating proportion of billets of an average girth of 15 inches.

Our curves show that coppice shoots 30 years old are, on the average, 12 inches to 16 inches in girth at breast height. And since the data for shoots over 17 years of age have been collected from areas worked under " Coppice with Standards ", a higher average can reasonably be expected in that period under the system of " Simple Coppice."

528. One other point that requires to be considered in fixing the rotation is the deterioration of the growing stock from one rotation to the next which must be avoided as far as possible. This difficulty is largely met by insisting on all trees being cut as close to the ground as possible, so that the new coppice shoots form new root systems of their own. However, in cases where new root systems are not formed, it is important that the rotation should not be so short as to cause deterioration owing to the strain of the too frequent production of new shoots nor so long as to cause deterioration due to the coppice shoots being too big.

529. Taking all the above factors into consideration, it has been decided that a rotation of 30 years is the most suitable, and this has therefore been adopted.

530. The total number of fuel felling series in the division is 75. Of these 63 are at present being worked on a rotation of thirty years, 9 on a rotation of forty years and 3 on one of 25 years. The prescribed rotation of thirty years will therefore cause a minimum of disturbance in working.

531. A longer rotation for localities belonging to the poorer qualities can scarcely be justified in this district ; the increment culminates earlier for such localities and any price increment consequent on a higher rotation is not likely to compensate for the fall in the Current Annual Increment. A uniform period of 30 years is therefore prescribed for all the fuel series under this plan, lying in the mixed deciduous type of forest. The statistics and the curves are filed with the working plan records.

532. *Rotation for Eucalyptus globulus.*—An area of one acre in the Gundan Shola Eucalyptus plantation was worked under simple coppice in 1923–24. Measurements were taken of 40 coppice shoots on this area in May 1935 when it was found that their average girth at breast height was 19·9 inches. The average girth for 11 year old coppice on the Nilgiris is 18·5 inches (page 14 of Mr. Dyson's Working Plan for the Nilgiris plantations). It appears therefore, that it would be safe to adopt here the rotation of 20 years prescribed for *Eucalyptus globulus* under simple coppice on the Nilgiris.

But the demand for our *Eucalyptus* fuel at Kodaikanal has been slack all these years though the increased sale of dead pine which has been noticed of late is an indication that private sources are no longer able to meet the entire public demand. There has also been a recent enquiry from the Kodaikanal Municipality for a maximum of 200 tons of fuel per annum for generating electric current for town lighting. It is however desirable to get rid of all dead pine before we work the Eucalyptus for meeting the demand from the general public. It is therefore necessary that we should release our Eucalyptus fuel in small quantities as the demand rises. A rotation of 30 years will result in smaller coupes and therfore in closer regulation of the supply : this rotation will therefore be adopted.

533. *Acacia decurrens.*—It is generally observed that the coppice shoots of *Acacia decurrens* (and *A. dealbata*) grow very rapidly. The mean of 63 girth measurements of coppice shoots three years old made in May 1935, near the Gundan shola Eucalyptus plantations, was 9·3 inches at breast height, i.e., over three inches per annum. But we know very little about the best rotation for this species. The area in this fuel series is small—only 20 acres and the supply will be confined to the village of Poombarai. A rotation of 10 years will be adopted tentatively, which will be subject to revision in the light of future experience.

534. *Interim rotations.*—A uniform rotation of 30 years has been proposed for adoption for all the fuel series (except for *Acacia decurrens*), some of which are now on a rotation of 25 years and some others on 40 years. An immediate change to a 30 year rotation would involve either a large diminution in the average area of future coupes, or a large increase, depending on whether the change is to a longer rotation or a shorter one. In order to minimise such large changes in the average area of coupes in a felling series, interim rotations lying between 25 years and 35 years have been adopted in the transition stage. A temporary lengthening of the rotation has also been found necessary for the same reason, where considerable areas have been added to some of the felling series. Such an adjustment in the transition stage is a recognised parctice in forest management.

535. *Regulation of working.*—The working will be regulated on an area basis. Each series has been divided on the maps into coupes of more or less equal area for the balance of the rotation. Large areas of rocky or unproductive ground included in a coupe have been stockmapped, so as to enable the District Forest Officer to allow for them when considering the reasonableness of an offer at the time of auction.

The boundaries of reserves have been corrected on the maps so as to agree with the actual demarcated boundaries. This will help in the laying out of coupes on the ground. Where a natural feature, such as a ridge or a stream, does not involve a complicated boundary difficult of survey, such a feature has been adopted as the boundaries of a coupe, wherever possible. Boundaries involving natural features will help to correct any errors in the survey of lines which do not follow such boundaries. In all cases of the lay out of coupes particular attention has been paid to facilities of extraction.

536. *Method of executing the fellings.*—One coupe in each of the " Commercial series " will ordinarily be felled every year.

537. In each of the " Reserve Felling Series ", one coupe will be put up to auction, every year, but if no reasonable offer is made, the coupe will not be sold, but will be re-auctioned year after year until the District Forest Officer is satisfied that there is no demand for fuel from that series, for the time being.

The main object with which " Reserve Felling Series " have been formed, which is to minimise illicit removals' should be borne in mind in deciding as to the " reasonableness " of an offer. The District Forest Officer may, with the sanction of the Conservator of forests, close any Reserve Series temporarily if he is satisfied that no reasonable offers are forthcoming, and may reopen it when a demand, local or distant, is found to arise.

538. In the "Kumri felling series" the main object is regeneration. The existing growth is, in the majority of cases, too poor to find a sale. Nevertheless, the annual coupe will be put up to auction. If the coupe does not find a sale, the growth will be cut free of cost by the Kumridars, and the District Forest Officer will allow them a limited quantity of fuel *for their domestic use only*, as compensation for the work involved. This quantity will be fixed at the discretion of the District Forest Officer, in each case. The balance will be piled up and burned in the coupe by the Kumridars.

539. In the case of the "Commercial Series," the working plan indicates the sequence of coupes to be felled as well as the year of felling. If a part or the whole of a coupe remain unfelled in any one year, the part or whole will be carried forward to the next year and will be felled along with the coupe of that year. Arrear coupes should not, however, ordinarily be carried forward for more than one year. Deviations from this prescription will require the sanction of the Chief Conservator.

540. In the case of the Reserve and Kumri series, only the sequence of coupes to be felled is laid down, without definitely allotting them to years. No deviation from the plan is therefore involved if a coupe in any of these series cannot be worked in a particular year. The fact should, however, be recorded in the Control Book, with full reasons.

541. *Demarcation.*—The coupe to be felled in each series will be surveyed and demarcated on the ground by lines cut into a width of 12 feet, with reference to the working plan map. The felling series boundaries at the top have been drawn in by eye, by the working plans staff, the upper limits being usually fixed with reference to natural features such as cliffs, ridges or grass land. Since they have not been plotted from surveys, the lengths of the boundaries of coupes cannot be obtained accurately by measurements on the maps. The Working Plan Maps should only be treated as a guide in laying out coupes, with special reference to their areas, and not as correct representations. The laying out of coupes has been further facilitated by correcting the Working Plan Maps so as to show the boundaries of reserves as they actually exist on the ground.

542. In surveying lines running up and down slopes care should be taken to measure distances *horizontally* and *not* along the slope.

Failure to attend to the points noticed above has resulted in wrong lay out of coupes in the past.

543. The correct area of the coupe will be computed on the basis of the survey. Any small difference between the actual area of the coupe and its nominal area as shown on the Working Plan Map, will not involve a deviation requiring sanction.

544. Every coupe will be divided into four strips on the ground by means of cut lines 6 feet wide. The strips shall invariably run up and down across the contours, on hill slopes, but may be in any convenient direction in plain terrian.

545. The average outturn of fuel that may be expected from the various felling series is now known approximately, as a result of the original stockmapping, the present stock-mapping and the figures of actual yield furnished by contractors. The felling of 'indicator areas' as a routine measure will not therefore be prescribed : this will relieve the rangestaff of some work, which is advisable in view of the new regeneration work prescribed. If the District Forest Officer considers that "indicator areas" are at any time necessary in any series, they may be felled in the current year's coupe through the coolies of the contractor over a demarcated area and the outturn measured up before removal by the contractor.

546. *Agency of felling.*—Felling shall be done generally through the agency of contractors, (except in the case of the Kumri felling series), the voidah for felling and removal for each coupe being normally 12 months, from the first of April to the 31st March of the succeeding year. The coupes shall be sold in public auction every year sufficiently in advance to enable the execution of agreements and the conveyance of the coupes to the respective lessees on the first of April. Coupes left unsold in the general sale but sold subsequently in special sales or by sealed tenders, should be leased only for the period ending on the 31st of the succeeding March. Extension of voidah as a matter of course should be avoided as it will dislocate the artificial regeneration operation prescribed herein.

547. If the electrification sheme for Kodaikanal matures and Eucalyptus fuel has to be supplied to the municipality for generating power, it may be found necessary to work departmentally one of the two fuel series in the Eucalyptus plantations. If such a contingency arises the previous sanction of the Conservator should be obtained for departmental working.

548. In the case of the Kumri Felling Series if a contractor cannot be found for a coupe it may be felled free of cost by the Kumridars under the conditions prescribed in paragraph 538 above.

549. In the case of the "Reserve Felling Series", panchayats from the concerned villages may be encouraged to purchase the coupes. The Assistant Registrar of Co-operative Societies for the District can render useful help in this direction.

550. A statement showing the average outturn, the cost of felling and transport to the market, and the average price realised for coupes in the various felling series is furnished below. It will in combination with the sale price current at the time, help the District Forest Officer to judge if fair prices are being offered at future auction sales.

Statement showing the average outturn, the cost of felling and transport to the market and the average price realised for the coupes in the various felling series in Madura division.

Serial number and name of felling series.	Indicator area outturn in tons.	Contractor's actuals per acre in tons.	Cost of felling and stacking per ton. RS. A.	Cost of extraction to road head and loading. RS. A.	Market.	Cost of transport thereto per ton. RS. A.	Estimated future average outturn per acre in tons.	Sale price per acre. RS. A.	Remarks.
					SHOLAVANDAN RANGE.				
1 Moruthu	..	6·8	0 12	..	Madura* ..	6 14	5·0	3 7	
2 Andipatti, West	7·3	7·4	1 0	1 4	Do.† ..	6 14	5·0	15 0	
3 Do. South ..	6·0	8·0	1 0	1 4	Do. ..	6 14	6·0	19 6	
4 Do. Central ..	5·0	5·5	1 0	1 4	Do. ..	7 0	5·0	17 6	
5 Rajadani, North	8·0	6·1	1 0	0 12	Do. ..	7 8	6·0	15 11	
6 Do. West	10·0	8·3	1 0	0 12	Do. ..	2 0	5·0	7 5	
7 Vikramangalam, East ..	2·2	3·1	1 0	0 8	Sholavandan ..	2 4	3·0	9 6	
8 Do. West ..	3·0	2·8	1 0	0 8	Usilampatti ..	3 8	4·0	4 0	
9 Waguthumalai	3·6	3·6	1 0	0 8	Madura ..	5 0	3·5	5 2	
10 Sirumalai, South ..	3·1	4·2	1 0	1 0	Do. ..	4 8	5·0	14 5	
11 Sathiar	8·0	8·5	1 0	1 0	Do. ..	4 0	5·0	9 2	
12 Sembatti	4·0	4·5	1 0	1 0	Do. ..	4 8	4·0	15 5	Sale price—Average for last five years.
13 Sirumalai East	..	4·9	1 0	1 0	Do. ..	3 12	4·0	13 4	
14 Anjukulipatti	11·6	9·1	1 4	1 0	Dindigul ..	3 0	6·0	7 4	Sale price—Average for last eight years.
15 Konapatti	..	6·5	1 4	1 0	Do. ..	2 0	4·5	13 7	Sale price—Average for last nine years.
16 Endlaparai	11·5	4·1	1 4	1 0	Do. ..	5 0	5·0	9 4	Do.
17 Ambathurai	4·6	2·8	0 12	0 8	{Madura / Chinnalapatti. .. }	1 12	3·5	4 3	Do.
					NATHAM RANGE.				
1 Perumalai East	7·0	8·4	1 0	0 12	Madura ..	6 8	4·4	18 1	Sale price—Average for last nine years.
2 Mulayur	..	7·1	1 0	0 12	Do. ..	6 8	4·6	13 12	
3 Chembulimalai	7·0	6·0	..	..	..	..	4·0	16 9	The produce is disposed by contractors to cartmen in the coupes at Rs. 6 per ton. The net gain got by the contractor per ton is Rs. 3.
4 Kadavur	..	8·1	..	..	..	..	5·0	21 9	The produce is disposed by contractors to cartmen in the coupes at Rs. 9 per ton. Net gain Rs. 6.
5 Alagarkoil	1·2	2·6	..	..	..	..	5·0	11 7	The produce is disposed by contractors to cartmen in the coupes at Rs. 6 per ton. Net gain Rs. 2-8-0.
6 Arukkampatti	10·3	5·5	1 4	0 12	Madura ..	8 0	5·0	9 8	Sale price—Average for last nine years.
7 Kasampatti	6·0	6·2	..	..	..	..	3·5	10 7	The produce is disposed of by contractors to cartmen in the coupes at Rs. 7-8-0 per ton. Net gain Rs. 3.
8 Thethampatti	..	9·2	1 4	1 0	Madura ..	5 0	4·8	16 14	Sale price—Average for last nine years.
9 Vemburli	4·1	8·0	..	..	..	..	5·0	18 11	
10 Budagudimalai	9·3	5·8	1 0	0 8	Madura ..	5 12	6·0	8 7	
11 Medugamalai, North ..	..	8·3	1 0	0 12	Do. ..	6 4	5·0	24 11	
12 Do. South ..	6·2	7·7	1 0	0 12	Do. ..	6 4	4·8	11 10	
13 Karumalai	9·5	8·3	1 0	0 12	Do. ..	8 0	5·8	24 13	Sale price—Average for last seven years.
14 Pottapatti	12·8	5·9	1 0	0 12	Do. ..	8 0	6·2	10 14	
15 Uduppagudi	3·4	8·1	1 4	0 12	Do. ..	8 0	5·8	18 0	
16 Karandamalai, East ..	10·0	9·8	1 0	0 8	Do. ..	6 4	6·0	14 7	
17 Do. North ..	13·8	10·5	1 0	0 12	Do. ..	8 0 ‡6 2	6·7	33 3	Sale price—Average for last eight years.
18 Do. West ..	..	7·9	1 4	0 8	Do. ..	8 0	5·0	22 10	Sale price—Average for last five years.
19 Perumalai	..	7·6	..	..	..	..	4·5	8 13	Sale price—Average for last nine years. The produce is disposed of by the contractors to cartmen in the coupe at Rs. 5-8-0 per ton. Net gain Rs. 3.
20 Kanavaipatti	..	8·3	1 0	1 0	Madura ..	8 0	6·5	18 11	
21 Kodangikuttu, North ..	9·8	9·7	0 12	0 8	Do. ..	{7 2 / ‡6 2	6·2	33 10	Sale price—Average for last nine years.
22 Do. South ..	12·0	13·2	0 12	0 8	Do. ..	{7 2 / ‡6 2	8·7	32 12	
					AIYALUR RANGE.				
1 Pillayarnatham, North ..	10·5	8·7	0 12 to 1 0	0 6 to 0 8	Madura ..	§6 3	4·2	42 10	Sale price—Average for last six years.
2 Pillayarnatham, South ..	6·9	7·3	0 12 to 1 0	0 6 to 0 8	Do. ..	6 3 ‖5 10	5·0	21 14	Sale price—Average for last nine years.
3 Kaluvadimalai	15·0	12·2	0 12 to 0 14	0 6 to 0 8	Do. ..	5 14	4·0	29 7	Sale price—Average for last nine years. Aiyalur to Madura by rail Rs. 3-6-0.
4 Sendurai	..	1·5	0 12 to 0 14	0 6 to 0 8	Do. ..	6 10	3·6	32 1	Sale price for one year. Vadamadura to Madura by rail Rs. 3-2-0.

* Fuel converted into charcoal—

	RS. A. P.
Cost of transport of one cartload of 35 bags from coupe to Usilampatti	4 8 0
Cost of transport of one cartload of 40 bags from Usilampatti to Madura	4 8 0
† Cart hire to Andipatti railway station	1 12 0
Loading in wagon	0 8 0
Railway freight	4 2 0
Unloading at Madura	0 8 0
Total ..	6 14 0

‡ Via Vadamadura.

§ Cart-hire from coupe to Kalpatti per ton, Rs. 3-11-0. Kalpatti to Madura by rail Rs. 3-11-0. Loading and unloading Re. 0-8-0. Total Rs. 6-3-0.

‖ Via Aiyalur.

Serial number and name of felling series.	Indicator area outturn in tons.	Contractor's actuals per acre in tons.	Cost of felling and stacking per ton.	Cost of extraction to road head and loading.	Market.	Cost of transport thereto per ton.	Estimated future average outturn per acre in tons.	Sale price per acre.	Remarks.
					AYYALUR RANGE—*cont.*				
			RS. A.	RS. A.		RS. A.		RS. A.	
5 Mudimalai	11·5	9·3	0 12 to 1 0	0 6 to 0 10	Madura ..	5 5	4·0	42 3	Sale price—Average for last five years.
6 Shorimalai	..	8·5	0 12 to 0 14	0 6 to 0 8	Do. ..	5 3	5·0	25 4	Sale price—Average for last two years.
7 Panjanthangi	8·2	11·1	0 12 to 1 0	0 6 to 0 8	Do. ..	5 6	5·0	39 4	Sale price—Average for last nine years.
8 A. Kombai	10·0	8·3	0 12 to 1 0	0 6 to 0 8	Do. ..	5 14	5·0	35 15	Do.
9 Pannamalai	6·9	7·1	0 12 to 0 14	0 6 to 0 8	Do. ..	4 10	2·0	35 9	Do.
10 Mungilkaradu	11·0	7·6	0 10 to 0 12	0 6 to 0 8	Do. ..	5 0	3·7	29 9	Sale price—Average for last five years.
11 Thopaswamimalai, North.	8·9	7·5	0 12	..	Dindigul ..	3 0 4 0	3·6	8 3	Sale price—Average for last nine years. 3 to 6 pies per bag for loading charcoal. 30 bags of charcoal one ton (cart-load).
12 Thopaswamimalai, Central.	6·0	6·6	0 12 to 1 0	0 6 to 0 8	Do. .. Madura ..	* 3 0 4 0 6 10	5·0	15 6	
13 Thopaswamimalai, South.	9·0	7·7	0 12 to 1 0	0 to 0 8	Do. ..	5 9	3·7	31 10	Sale price—Average for last nine years.
14 Veeramalai	2·7	3·3	0 12 to 1 0	0 8 to 0 10	Do. ..	7 3	3·0	12 4	Sale price—Average for last seven years. Manaparai to Madura by rail, Rs. 4–3–0 per ton.
15 Karpur Reddiapatty ..	..	8·9	0 12 to 1 0	0 6 to 0 8	Do. ..	..	6·0	47 7	Sale price—Average for last nine years. From coupes to Vyampatti railway station Rs. 1–8–0 to 2–0–0 per ton.
16 Semmalai	2·0	2·3	0 12 to 1 0	0 6 to 0 8	Do. ..	5 3	5·0	18 2	Sale price—Average for last nine years.
					KODAIKANAL RANGE.				
1 Adukkam	..	5 0	0 12	1 8	Periyakulam ..	3 0	5	11 5	
2 Amburuvi	..	2·4	0 12	1 8	Do. ..	3 0	6	8 2	Sale price—Average for last two years.
3 Pambar	10·0	7·6	0 12	1 4	Do. ..	3 0	5	16 7	
4 Iruttar	4·5	3·9	0 12	1 0	Do. ..	5 0	5	8 9	
5 Sadayaperumal	..	1·7	0 12	1 4	Batlagundu ..	3 8	4	2 10	
6 Murugamalai	..	3·3	0 12	1 8	{ Devadanapatti. } { Periyakulam .. }	2 0 4 0	5	5 6	
7 Mankaradu	..	2·3	0 12	1 0	Batlagundu ..	2 8	3	1 15	Sale price—Average for last five years.
8 Agamalai	..	1·7	0 12	1 0	Theni ..	2 0	4	1 12	Sale price—Average for last four years.
					PALNI RANGE.				
1 Virupakshi	..	3·6	1 10	1 4	Madura ..	† 2 2	6	7 5	Sale price—Average for last five years.
2 Palni	..	4·1	1 8	..	Palni ..	..	3	2 7	Sale price—Average for last three years. Produce removed in headloads only.
					CUMBUM RANGE.				
1 Kombai	9·0	6·9	1 0	..	Kombai and Uthamapalayam.	..	4	4 10	Produce removed only in headloads. Sale price—Average for last nine years.
2 Machakkal	17·5	14·2	1 0	..	Gudalur and Cumbum.	..	5	30 0	No stacking is done. Consumers billet and remove produce by paying value for the stuff.
3 Surulipatti	9·5	8·6	1 2	..	Cumbum and other villages.	..	6	10 5	Do.
4 Suranganar	..	5·6	1 0	..	Gudalur and Cumbum.	..	8	14 3	No stacking is done. Consumers billet and remove produce by paying value for the stuff Good quality of small timber is available from this series.
5 Pudupatty	10·5	5·6	1 0	..	Cumbum and Uthamapalayam.	..	4	7 0	Produce removed only in headloads. Sale price—Average for last eight years.

* Charcoal goes to Dindigul.

† Rs. 2–2–0 is the charge from coupe to Oddanchatram railway station.

NOTE.—(1) The contractor's actuals are averages for the last two to five years.
(2) Indicator area outturn is given from figures of one year's felling between 1929–30 and 1931–32.
(3) Sale price per acre—The average for the last ten years except where otherwise indicated.

551. *Arrears of coupes.*—In the event of any portion of a coupe remaining unfelled at the close of the period of lease, such portion shall be left unfelled.

552. *Felling and extraction rules.*—(1) The coupe shall be felled strip by strip. A new strip may be entered into only after the Range Officer has personally satisfied himself that the work in the previous one has been satisfactorily completed. The felling should be regulated, as far as possible, so as to keep pace with the period of contract : each strip should be felled within three months.

(2) No tamarind, *Terminalia chebula* or sandal trees inside the coupe may be felled by the contractor, except such old, or unsound tamarind trees as have been expressly authorized to be felled by the District Forest Officer, on the ground that they have either ceased to bear fruit or are not likely to survive for another rotation.

(3) Evergreen trees of large size (such as *Mangifera indica*, and *Terminalia arjuna*) standing on the banks of streams shall not be felled : but dead, dying or overmature trees among them may be cut and removed after obtaining the specific orders of the District Forest Officer in each case.

(4) Trees prohibited from felling under Rules (2) and (3) above, will be generally marked and numbered with tar before the coupe is offered for sale, except sandal seedlings of a size which does not permit of such marking. The absence of any marks or numbers, however, should not be considered by the lessee as authority for felling such prohibited species.

(5) The contractor shall not be bound to cut thorny climbers, creepers, undergrowth of all kinds, and softwooded species of no sale value, except where such growth stands on rab-lines. *All* growth of any kind standing on rab-lines, with the exception of species prohibited from felling under Rules (2) and (3) above, should be cut back to ground level and the resulting slash heaped up as prescribed in Rule (9) below.

(6) All other woody growth shall be cut cleanly, with *sharp* axes or billhooks, as close to the ground level as possible, in such a manner that *the bark is not separated from the wood*. It is not necessary that the woody portion of the stool should be trimmed smooth so long as the *bark* is intact. No stool may be re-trimmed except under the express orders of the District Forest Officer.

(7) The contractor may construct, at any time, cart tracks in any part of the coupe, irrespective of the strip he is working in. He will make only the minimum number of earth-slides that are absolutely necessary for the extraction of firewood from the upper slopes. The use of wire-ropes for extraction purposes, a method not uncommon in this division, should be encouraged : the departmental purchase of wire-ropes for the purpose of hiring them out to contractors has been provided for under paragraph 871.

(8) All felled wood should be billetted and stacked prior to removal. No removal of billets 6 inches in girth or more shall be allowed except after stacking. All fellings in the coupe shall be made only by the coolies of the contractor ; either he or his authorized agent shall be present personally during fellings.

The *removal* of felled material under 6 inches in girth on headload tickets issued by the contractor may be allowed without prior stacking, provided, that in coupes where *debris* for the *rab* sowings prescribed below is insufficient, the District Forest Officer may limit or prohibit the sale of such tickets.

(9) All brushwood and felled material, *in the first one strip of the coupe*, not required by the contractor, or the removal of which has been prohibited by the District Forest Officer, should be heaped up in strips running along the contours. The strips shall normally be about one chain apart and about nine feet wide. The heaps of slash will be broken to avoid live coppice stools, coppice shoots and seedlings and living trees of sandal and tamarind, a clear space of about 6 feet on either side of them being left. In the case of sandal, a wider space than 6 feet will probably be necessary. The brushwood should be closely piled and beaten down. The District Forest Officer should get this done by the coupe contractors as a condition of their leases : the abolition of the current practice of trimming stools after felling will, it has been found in other districts, more than compensate for the work involved.

The distance between strips and the width of the heaped-up slash will vary in accordance with the amount of slash available. No dearth of slash is however normally anticipated and it should be borne in mind that a wide strip helps to minimise invasion by weeds and creepers from the surrounding unburnt area.

(10) Bamboo clumps found inside a fuel coupe may be exploited by the fuel coupe contractor, but their felling and extraction should be in accordance with the rules prescribed for the Bamboo Working Circle in Chapter VI of Part II. As far as possible bamboos have been excluded from Fuel felling series.

SECTION 5.—REGENERATION.

553. The history of the supply of fuel to the city of Madura sketched in paragrapsh 184, 189 and 212–215 of Part I of this plan will amply indicate the necessity for ensuring as high a sustained supply of firewood from the fuel forests of Madura as they can be made to yield.

It is therfore imperative that the existing fuel resources should not only be conserved but should be augmented as far as may be practicable. A reference to paragraphs 47 to 54 of Part I of this plan will show that (1) the density of the crop is low in some localities, as a result of heavy fellings in the past, extensive illicit removals, and inclusion of abandoned cultivation in reserves,

(2) a certain proportion of the stools resulting from coppice fellings fail to throw out shoots for various reasons,

(3) softwooded species of no value have often invaded fuel areas to the exclusion of useful species, and that,

(4) natural regeneration of useful species from seed does not occur in sufficient quantities to replace the losses noted above.

Artificial regeneration is therefore prescribed in all fuel coupes after felling.

554. The general rule will be "rab" regeneration, which consists in sowing seeds in the strips referred to above on which all growth has been cleared and slash has been burnt.

Kumri regeneration will also be tried experimentally; this method is especially applicable to degraded areas; it was initiated, in this division, by the writer in 1933. Details of the experiments made are given in paragraphs 348 to 354 of this plan.

555. "Rab regeneration" of fuel coupes in the Madura forests was started on an experimental scale in 1929. The details of work done so far will be found in paragraph 300 of Section 5 of Chapter V of Part I. The work has not yet been organized completely, but encouraging results have been achieved in many localities.

556. "Kumri regeneration" in fuel coupes was started experimentally in this division in 1933.

The results have been encouraging so far in degraded areas; but whether or not the system is suitable for general regeneration of fuel coupes can be decided only after practical trial on a larger scale.

There has been an unexpectedly large demand during 1935, from villagers in Natham range, for such areas for Kumri regeneration; but it is clearly inadvisable to advance too rapidly with a new departure such as this is, since neither the villagers nor our staff have had any extended experience with the method.

557. Both the methods of artificial regeneration prescribed above being still in the experimental stage, frequent consultation with the Provincial Silviculturist is desirable to ensure that the latest available results are successfully applied.

558. The number of fuel series in each of the six ranges of the division, and size of the average area to be felled annually in each range, are as follows:—

Range.	Number of fuel series.	Average annual felling area in acres. (Area of coupes.)
Natham	24	1,567
Sholavandan	18	1,179
Ayyalur	21	1,667
Cumbum	6	391
Kodaikanal	11	386
Palni	6	248
Total	86	5,438

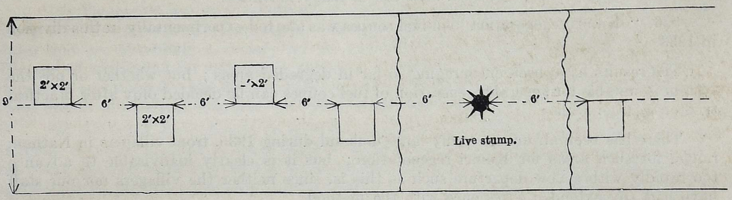
559. The first strip of every fuel coupe, i.e., approximately one-quarter its area, shall be regenerated by the rab method each year, provided that no forest guard is required to attend to the regeneration of more than one coupe at a time, unless the District Forest Officer considers that it is possible for the Forest Guard to undertake more. In all series where there is a demand for Kumri the District Forest Officer will arrange for suitable additional areas, to be regenerated under this system.

560. *Rab regeneration.*—The first one strip of every coupe, amounting approximately to quarter its total area, shall be regenerated in the year of felling. This strip should normally be ready for sowing by the end of September; every effort must be made to ensure that it is handed over in time for regeneration during the north-east monsoon, as thereby a whole season's growth will be gained, and of still greater importance, there will be a minimum amount of damage to the new coppice growth. If necessary a clause may be inserted in the contractor's agreement, to this effect.

561. The slash stacked in broken lines as prescribed in paragraph 552 (9), will be burnt carefully by the beat subordinates as soon as it is dry. A good hot burn should be secured as this will help to keep out weedgrowth for at least a year. The ash in the burnt lines should then be well raked into the soil in order to prevent it from being blown away.

562. The soil in the burnt lines should then be prepared : advantage should be taken of the first of the north-east monsoon showers, which will facilitate and cheapen the work.

563. Patches about 2 feet square will be hoed to a depth of not less than 6 inches, in two parallel lines alternating with one another, omitting places where there are live trees, seedlings or coppice shoots of good species [Vide paragraph 552 (9)]. The distance between the patches may be six feet from edge to edge. The broken up soil and ash should be put back into the patch, which will result in its being slightly raised above the surrounding level. All stones dug out in the operation may be loosely packed round the patch in level country, and on its lower side on slopes, to prevent soil wash. The details of rab regeneration work prescribed in this (and in the preceding and following paragraphs) may be altered with the approval of the Conservator in the light of experience gained. The following diagram illustrates the arrangement suggested above :—



564. A list of species recommended for "rab" sowings is furnished below, with notes on collection of seeds, seed weight, and the localities specially suited for each species. Other species may be tried in consultation with the Provincial Silviculturist and with the sanction of the Conservator :—

Species recommended for Rab-sowings.

Serial number and species.	Time of collection of seed.	Approximate number of seeds per ounce.	Remarks.
1 *Acacia planifrons* ..	July—September ..	600	Will suit all soils, but particularly good for poor rocky soil, and along fuel slides.
2 *Acacia ferruginea* ..	March—April ..	157	Medium and good soils—quick grower.
3 *Acacia leucophloea* ..	April—June	1,300	All soils, but specially for stiff clayey loam.
4 *Acacia latronum* ..	February—March ..	..	Specially suited for poor stony soils.
5 *Albizzia lebbek*	March—June ..	200	Grows from cuttings—specially suited for good loamy soil on stream banks—fast grower—valued as timber.
6 *Albizzia amara*	January—March ..	400	Good fuel and small timber.
7 *Albizzia odoratissima* ..	February—April ..	..	
8 *Chloroxylon swietenia* ..	May—August ..	3,200	Use fresh seed, collect from trees—germinates in about 10 days.
9 *Prosopis spicigera* ..	June—August ..	740	Suited admirably for dry localities.
10 *Melia indica*	June—August ..	..	Sow fresh fruits collected from trees.
11 *Sapindus emarginatus* ..	February—April ..	25	
12 *Tamarindus indica* ..	March—May	..	
13 *Pithecolobium dulce* ..	May—July	..	Particularly suited to sandy places.
14 *Dolichandrone falcata* ..	April—June	..	
15 *Cassia siamea*	March—April ..	1,085	Particularly recommended.
16 *Cassia montana* ..	February—March ..	..	Shrub, particularly suited for rapidly filling up blanks.
17 *Cleistanthus collinus* ..	....	..	Small timber of value.
18 *Canthium didymum* ..	....	..	Valued highly as fuel. Grows under all conditions where the soil is not too poor.

565. The most important of the species listed above are, *Albizzia amara*, *Albizzia lebbek*, *Acacia planifrons*, *Acacia ferruginea*, *Melia indica*, *Cassia siamea* and *Chloroxylon swietenia* : they should be given preference over other species. With this proviso, the number and proportion of the various species to be used in the different localities concerned is left to the discretion of the District Forest Officer. *Acacia ferruginea*, *Albizzia lebbek*, *Melia indica* and *Chloroxylon swietenia* have been prescribed with a view to provide some timber for agricultural purposes.

566. Several species should be sown in each patch, as soil conditions vary considerably even in the same coupe, and our knowledge as to what exactly is most suitable is at present very limited.

567. A sufficient number of seeds should be dibbled in each patch to ensure, as far as is possible, a good stock of young trees.

568. No part of the area to be regenerated may be left untreated except sheet rock and other places which cannot support tree growth of any kind.

569. Dibbling shall be done early in the north-east monsoon.

570. Casualties should be replaced by sowings early in the following south-west monsoon.

The total cost for rab regeneration is estimated not to exceed Rs. 1–8–0 per acre, out of which pitting may cost 8 annas to 12 annas.

571. *Quantity of seeds required.*—With "rab" lines normally 1 chain apart and seed patches spaced 8′ from centre to centre, about 82 patches will go to the acre, not making any allowance for interruptions on account of live trees or coppice stools. It is not possible to say exactly how many seeds will be required, in view of the fact that they vary so greatly in size and in germinative capacity. It is however very evident that large quantities will be necessary and that early steps must be taken to organise the collection of a sufficient quantity of good seed at the proper time and to store it carefully until it is used. The Provincial Silviculturist should be consulted in plenty of time as to the quantities that will be required and, if they cannot be collected within the district, he should be asked to help with supplies. This instruction must, however, not be taken by the local officers as absolving them from the duty, which is primarily theirs, of making provision for their own requirements if it is possible for them to do so.

572. *Weeding and tending.*—If the burn has been satisfactory very little weeding should be necessary in the first year, but climbers spreading from the unburnt portions of the coupe may have to be kept back in certain localities. At least one soil working round the plants should be done soon after the last rains in January in order to conserve the moisture and aerate the rootsystem as this will help to enable the plants to survive the ensuing hot weather.

A cleaning and tending with the objects of freeing the plants from interfering climbers and of thinning out of excess plants may be found necessary between the 3rd and 5th year. No definite prescription can however be laid down now as our knowledge of such requirements is limited. Suitable prescriptions will be framed by the District Forest Officer, when necessary, in consultation with the Provincial Silviculturist and with the sanction of the Conservator. Any natural regeneration from seed found in the coupe should be tended along with the artificial seedlings.

573. The coppice regeneration of *Eucalyptus globulus* and the Australian wattles is generally so satisfactory that no artificial regeneration need be undertaken in the concerned fuel series during the period of this Working Plan.

574. *Kumri regeneration.*—The experimental regeneration of a degraded fuel coupe in combination with agricultural crops described in paragraphs 348—354 yielded very promising results. It was therefore decided in 1935, in consultation with the Conservator of Forests and the District Forest Officer, to extend the experiment to other fuel coupes which were not so degraded. Accordingly, agreements have been executed for the Kumri regeneration of 51·5 acres spread over 5 coupes in the Ayyalur range and of 50·2 acres over 4 coupes in the Natham range and 21 acres of one coupe in Sholavandan range.

575. If carried out with ordinary care and supervision this method is capable of giving good results, it costs little and it helps the ryot. But before it can be applied to the better type of fuel forest where the existence of coppice shoots of valuable species cannot be ignored, it must be given sufficient practical trial.

576. The method is defective in that (1) a general burn over the area is likely to kill all stools if the available slash be sufficient for an intense fire, (2) even without an intense fire the cutting and burning of the young coppice shoots may endanger the survival of the stool, though the indications are that, if the first fire is not severe, the stools are likely to survive, (3) it is not yet known whether the seedlings raised by "kumri" will yield, at the end of the rotation of 30 years, as much fuel as the coppice shoots would have done and (4) it obviously cannot be applied to areas on steep slopes, as the cultivation of field crops in such localities would result in denudation.

577. The method of " kumri " regeneration described below will be applied to the whole area of the coupes in the two kumri felling series prescribed in the plan. It may be extended to coupes of other fuel series later, if it proves to be a successful and satisfactory method of regeneration after prolonged trial.

Before this is done, however, the orders of the Chief Conservator of Forests must be obtained.

578. The following points are emphasized :—

(*a*) The method is best suited to degraded fuel forests on flat terrain. Localities falling under this class have been specified in the statement under paragraph 519 above.

(*b*) Steep slopes should not be subjected to " Kumri " regeneration.

(*c*) In coupes taken up for kumri regeneration, the slash to be burned should not be heaped up on or near the stools of valuable species where this is practicable : there is reason to believe that a stool is often able to survive two or more fellings but that it is likely to succumb to a hot fire.

579. The following procedure should be adopted in regenerating areas taken up for kumri regeneration :—

(1) The area to be leased to each individual kumridar should be fixed with reference to his capacity. It should be surveyed beforehand and a sketch of it should be attached to the agreement to be entered into between him and the District Forest Officer, which should provide for the following conditions. The area should be handed over to the kumridar by the end of April, on his executing such an agreement.

(2) It is desirable to select for kumri that part of a coupe which was last vacated by the contractor, since fewer stools will have thrown out coppice shoots in such areas. This does not apply to coupes in kumri felling series, which will be taken up entire.

(3) The kumridar shall cut any standing tree growth and pile it in convenient heaps, together with the slash left behind by the coupe contractor. As far as possible the heaps should not be piled on or near any living trees or stools of valuable species. The heaps should be burned before the end of June.

(4) The kumridar shall then plough or otherwise prepare the soil for growing field crops. Where, on account of stumps, no ploughing is possible, the soil may be prepared with hoes or other implements in such manner as is common practice in the locality.

(5) Strips of worked up soil four feet broad shall be demarcated at an espacement of 22 feet from centre to centre (18 feet from edge to edge) for the reception of the seeds of tree species. The strips will run approximately along the contours on slopes but along the shorter edge of the area on the level. Each strip will be staked at either end and given a number.

(6) The kumridar may grow any agricultural crop he wishes to raise in the area between the four feet strips reserved for tree species. It is likely that some crops may prove to be more beneficial to the tree seedlings than others, but we have as yet no information on this point. This question should be decided on the results of future operations.

(7) The kumridar shall supply labour to the department whenever demanded for the sowing and resowing of the four-foot strips. The labour will be paid for at rates fixed beforehand.

(8) The seeds of tree species will be dibbled simultaneously with the sowing of the agricultural crop, in two lines one foot apart, in the middle of the four foot strips. This will normally be done with the onset of the North East monsoon.

(9) The species to be dibbled will be selected from those prescribed for rab regeneration.

(10) The kumridar shall take care of the seedlings in the strips and shall keep the strips clean wedded to their full width, free of cost, until he vacates the area.

(11) The soil in the strips shall be picked and loosened all round the seedlings by the kumridar, free of cost, in February—March, befoie he may be permitted to remove his field crop.

(12) If, at the end of the first hot weather, the strips are not sufficiently well stocked with seedlings of fuel species the area may be let out again for kumri in the next agricultural season. But this should rarely be necessary and is advocated only in exceptional cases. The District Forest Officer must get the Conservator's orders before allowing any 2nd year cultivation.

(13) A general burn over such an area shall not be again permitted, however. Any regrowth from stools and all other standing growth, with the exception of that standing on the partly regenerated strips, may be cut and piled in small heaps between the strips, but remote from live stools, and burned in such a manner as will not cause injury to the regeneration in the strips or to the live stools.

(14) The blanks in the partly regenerated strips will then be dibbled with suitable species at the time when the field crop is sown again. The first year and second year seedlings in the strips will be kept weeded by the kumridar as before and a soil mulching done by him prior to his vacating the area finally.

580. *Tending.*—Weeding and tending for the first one or two years, as the case may be, will be done free by the kumridar. What tending will be required after the kumridar quits the area has to be decided only with reference to future observations and experience. The seedlings in the strips will often be found growing close together and it may be desirable to thin them out. This matter is left to the discretion of the District Forest Officer.

SECTION 6.—SUBSIDIARY REGULATIONS.

581. *Demarcation.*—The practice of planting demarcation stones round coupes *before* they are actually leased out has created considerable confusion in cases where the coupes remained unsold or unworked. Stones should therefore in future be planted only *after the completion of* fellings.

The demarcation should refer to the area leased out, and not only to that actually exploited during the year, if there be arrears. The legend on the stones should exhibit the number of the coupe and the year of exploitation as well as the number of the adjoining coupe and its year of working. Only the four salient corners need to be demarcated where the coupe is bounded by more than four straight lines.

When an adjoining coupe remains unexploited in the succeeding year, the corresponding year of felling marked on the common coupe stones should be suitably altered to the actual year of felling.

The number of a coupe is governed by the *actual* sequence of *fellings* and not by the number originally allotted to it. Hence, when the sequence of coupes prescribed in the plan is replaced by a revised sequence, the numbers of the coupes should also be revised to conform with the new sequence. For instance, let us suppose that Coupes I—VI have been felled and that, instead of coupe VII, Coupe XXX as marked on the map is felled next ; the felled coupe should be given the number VII and not the number XXX.

The numbers on the coupe stones of coupes felled in the past should be suitably altered in conformity with this rule wherever the coupes prescribed under this plan are in sequence with the coupes felled in the past.

582. *Supply of local demands.*—The contractor shall be required to sell to the ryots fuel, thorns and small timber for domestic and agricultural purposes, on demand at the coupe, at retail rates fixed by the District Forest Officer.

583. *Statistics.*—Every contractor shall be required to furnish monthly statements showing (1) the quantity of fuel, in stacks of specified dimensions, *felled* and *stacked* during the month in each strip, (2) the quantity of fuel, in cartloads or by weight, actually removed during the month from each strip, (3) the species, descriptions and volume in c.ft of any timber extracted from each strip, and (4) the quantity of fuel sold in headloads, from each strip.

584. *Grazing.*—Fuel coupes will be normally closed to grazing for a period of ten years after the completion of exploitation : this period is the indispensible minimum in view of the artificial regeneration prescribed.

If, in the opinion of the District Forest Officer, certain specified coupes require to be closed to grazing for a longer period for silvicultural reasons, the period of such closure should be fixed by the Conservator.

All closed areas should be distinguished by painting the reserve pillars *red* on the common boundary between closed and open areas or by prominent notice boards painted half red and half white, in the recognized manner. This distinguishing mark should be shifted to the proper place as areas are closed or opened.

The opening of pens in the Cumbum range has been recommended : this will reduce the intensity of grazing in fuel areas.

585. *Fire protection.*—The fuel areas of the division are not usually susceptible to fire except where they extend into the higher grassy slopes of hills or are situated, as in rare cases, in grassy localities. The areas where fires are likely to occur are confined to the Waguthamalai and the higher slopes of the Karandamalais, Alagar hills, Thoppaswamimalai, Mudimalai, Sirumalais, the Andipatti hills and the Palnis. The fire protection of the areas mentioned above will be secured under the methods prescribed for general fire protection, in Chapter XI. Prescriptions for the special protection of fuel coupes against fires are therefore considered unnecessary.

586. *Destruction of climbers.*—Thorny climbers such as *Acacia intsia*, *Caesalpinia mimosoides*, *Pterolobium indicum* and *Zizyphus oenoplia* are a serious pest in some of the coupes in the Sathiar Anjukulipatti (Sholavandan range), Suranganar, Machakkal and Vannathiparai (Cumbum range) felling series. The possibility of eradicating such climbers by poisoning has been demonstrated by the Provincial Silviculturist and the method described by him in his C. No. 1126/35, dated 6th September 1935 and in the Silvicultural Research Report for 1934–35.

The eradication of thorny climbers in the coupes of the series mentioned above should be tried experimentally for a period of three years. One coupe in each of the two ranges (Cumbum and Sholavandan) may be treated every year, the selection of coupes being left to the discretion of the District Forest Officer ; areas selected should be those which will come under felling one to three years later. It is important to keep a careful record of costs and results as experiments on a commercial scale, such as this, are necessary to confirm results obtained on a smaller scale by the Provincial Silviculturist. He should be consulted as to the form in which such records may most usefully be maintained.

The poison is made up of 3 lbs. of Sodium carbonate (bazaar washing soda) dissolved in half a gallon of water, in a kerosene tin, to which is added one pound of Arsenious oxide (poison). The mixture is heated and stirred well until the poison is completely dissolved adding more water if necessary, in case there is any precipitate. More water is then added to make up 1 gallon in all. This is the stock from which the solution for use is made as necessary by adding to the quantity taken at any one time twice its volume of water. It is a virulent poison and must be most carefully used, and all possible precautions taken, such as are suggested in the Provincial Silviculturist's note referred to above, to prevent accidents.

The climbers to be poisoned should be girdled down to the cambium (*but not deeper*) with a girdle 9″—1′ in length, the bottom of the girdle being about 3″ from ground level. The poison should be painted on the girdle immediately it is made, using a flat brush about $1\frac{1}{2}'' \times \frac{1}{3}''$ at the end.

The poisoning is best done in dry weather, in December-January, when the solution is not likely to be washed away by rain.

The operation may have to be repeated a second time, after one year, to destroy any shoots which may still be alive.

More detailed instructions will be found in the report of the Provincial Silviculturist mentioned above. The warning about the extremely poisonous nature of the solution (Arsenious oxide) can scarcely be over-emphasised. Every precaution must be taken to see that it is used with scrupulous care.

SECTION 7.—CONTROL.

587. The District Forest Officer shall maintain a Control Book, Record of Works, a Regeneration Ledger, and a set of Control maps.

588. The Control book will contain a record of all operations carried out in connexion with the exploitation of firewood on each felling series. In the remarks column will be recorded a girthwar list of each species of trees within the coupe protected from felling. In the case of bamboos, the total number of clumps in the coupe will suffice.

589. The Record of Works will exhibit all measures carried out for the regeneration and improvement of the areas in the Fuel Working Circle.

590. The Regeneration Ledger (common to all Working Circles) will record the details of the operations undertaken to regenerate the fuel coupes under the methods of " rab " and " kumri " and their cost. Specimen control forms will be found in Appendix VI (*d*), (*f*), (*k*) and (*l*).

591. The control maps should show the boundaries of the coupe as laid out on the ground for sale, the area actually felled during the currency of the lease, and any arrears. The felled area should be given a wash of Burnt Sienna and the year of working should be noted in the middle of the coupe. Where arrears are worked subsequently the actual year of working should be entered in the arrear area. The completion report received from the Range Officer should contain a plan of the coupe or part of the coupe actually felled by the contractor, on the basis of which entries on the control maps will be made.

Tabular statement of fellings—Fuel Working Circle.

Serial number and name of felling series.	Commercial, Reserve or Kumri.	Years. 1936–37. C. No.	1936–37. Area. ACS.	1937–38. C. No.	1937–38. Area. ACS.	1938–39. C. No.	1938–39. Area. ACS.	1939–40. C. No.	1939–40. Area. ACS.	1940–41. C. No.	1940–41. Area. ACS.	1941–42. C. No.	1941–42. Area. ACS.	1942–43. C. No.	1942–43. Area. ACS.	1943–44. C. No.	1943–44. Area. ACS.	1944–45. C. No.	1944–45. Area. ACS.	1945–46. C. No.	1945–46. Area. ACS.
SHOLAVANDAN RANGE.																					
1 Moruthu	Commercial	..	48	..	46	..	44	..	46	..	40	..	40	..	40	..	40	..	44	..	46
2 Andipatty West	Do.	..	70	..	71	..	67	..	70	..	67	..	74	..	80	..	75	..	78	..	78
3 Andipatty Central	Do.	..	83	..	70	..	80	..	80	..	71	..	70	..	73	..	80	..	82	..	84
4 Andipatty South	Do.	..	68	..	60	..	59	..	66	..	66	..	65	..	78	..	78	..	80	..	84
5 Rajadani North	Do.	..	57	..	54	..	61	..	60	..	61	..	60	..	64	..	53	..	52	..	54
6 Rajadani West	Do.	..	42	..	35	..	36	..	35	..	34	..	34	..	36	..	35	..	38	..	35
7 Vikramangalam East	Do.	..	49	..	48	..	54	..	52	..	64	..	63	..	61	..	60	..	60	..	58
8 Vikramangalam West	Do.	..	58	..	58	..	57	..	49	..	52	..	51	..	50	..	47	..	50	..	54
9 Waguthumalai	Do.	..	64	..	57	..	78	..	68	..	66	..	68	..	67	..	74	..	67	..	77
10 Sirumalai South	Do.	..	95	..	96	..	95	..	96	..	91	..	93	..	99	..	99	..	99	..	101
11 Sathiar	Do.	..	69	..	67	..	76	..	76	..	73	..	75	..	74	..	77	..	73	..	73
12 Sembatti	Do.	..	89	..	90	..	89	..	81	..	90	..	89	..	89	..	89	..	87	..	89
13 Sirumalai East	Do.	..	71	..	89	..	84	..	83	..	80	..	80	..	81	..	82	..	84	..	81
14 Anjukulipatty	Do.	..	70	..	68	..	72	..	70	..	70	..	69	..	69	..	68	..	70	..	69
15 Konapatti	Do.	..	52	..	53	..	58	..	69	..	61	..	53	..	54	..	66	..	65	..	63
16 Endlaparai	Do.	..	90	..	88	..	86	..	86	..	80	..	84	..	84	..	87	..	73	..	74
17 Ambathurai	Do.	..	76	..	75	..	77	..	72	..	75	..	75	..	75	..	75	..	66	..	71
18 Koilpatty	Kumri	..	30	..	30	..	30	..	30	..	30	..	30	..	30	..	30	..	30	..	30
NATHAM RANGE.																					
1 Perumalai East	Commercial	..	43	..	43	..	43	..	43	..	44	..	43	..	42	..	43	..	45	..	49
2 Mulayur	Do.	..	91	..	94	..	89	..	88	..	98	..	81	..	89	..	89	..	94	..	98
3 Chembulimalai	Do.	..	73	..	78	..	80	..	70	..	65	..	65	..	68	..	72	..	74	..	81
4 Kadavur	Do.	..	80	..	82	..	80	..	80	..	84	..	72	..	84	..	84	..	84	..	75
5 Alagarkoil	Do.	..	57	..	57	..	57	..	54	..	56	..	56	..	56	..	55	..	56	..	55
6 Arakampatty	Do.	..	43	..	41	..	41	..	45	..	46	..	44	..	45	..	44	..	45	..	45
7 Kasampatty	Do.	..	66	..	80	..	56	..	55	..	66	..	59	..	64	..	64	..	62	..	61
8 Thethampatty	Do.	..	52	..	64	..	66	..	65	..	58	..	59	..	62	..	59	..	58	..	58
9 Vemburli	Do.	..	51	..	54	..	53	..	58	..	51	..	53	..	47	..	44	..	42	..	55
10 Pudagudimalai	Do.	..	83	..	80	..	82	..	78	..	81	..	90	..	81	..	83	..	82	..	118
11 Medugamalai North	Do.	..	54	..	55	..	57	..	52	..	56	..	58	..	58	..	60	..	53	..	58
12 Medugamalai South	Do.	..	55	..	52	..	55	..	56	..	50	..	53	..	59	..	53	..	49	..	51
13 Karumalai	Do.	..	46	..	49	..	49	..	44	..	48	..	47	..	46	..	47	..	48	..	49
14 Pottapatti	Do.	..	65	..	50	..	74	..	74	..	49	..	49	..	49	..	50	..	50	..	46
15 Uduppagudi	Do.	..	82	..	83	..	83	..	83	..	120	..	94	..	87	..	94	..	86	..	90
16 Karardamalai East	Do.	..	57	..	72	..	69	..	71	..	73	..	70	..	67	..	71	..	70	..	73
17 Perumalai	Do.	..	61	..	74	..	74	..	73	..	74	..	85	..	79	..	80	..	80	..	84
18 Kanavaipatty	Do.	..	79	..	79	..	79	..	79	..	79	..	76	..	78	..	81	..	74	..	87
19 Karandamalai North	Do.	..	81	..	87	..	85	..	103	..	106	..	104	..	96	..	96	..	104	..	101
20 Karandamalai West	Do.	..	100	..	101	..	102	..	105	..	104	..	100	..	110	..	124	..	109	..	109
21 Kodangikuttu North	Do.	..	56	..	57	..	57	..	59	..	57	..	59	..	58	..	58	..	59	..	59
22 Kodangikuttu South	Do.	..	59	..	62	..	61	..	63	..	62	..	58	..	60	..	60	..	60	..	60
23 Periaruvi	Do.	..	42	..	40	..	41	..	40	..	40	..	41	..	40	..	42	..	40	..	40
24 Vellalapatti	Kumri	..	45	..	45	..	45	..	38	..	38	..	38	..	38	..	40	..	38	..	38

Tabular statement of fellings—Fuel Working Circle—cont.

Serial number and name of felling series.	Commercial, Reserve or Kumri.	1936–37. C. No.	1936–37. Area.	1937–38. C. No.	1937–38. Area.	1938–39. C. No.	1938–39. Area.	1939–40. C. No.	1939–40. Area.	1940–41. C. No.	1940–41. Area.	1941–42. C. No.	1941–42. Area.	1942–43. C. No.	1942–43. Area.	1943–44. C. No.	1943–44. Area.	1944–45. C. No.	1944–45. Area.	1945–46. C. No.	1945–46. Area.
			ACS.		ACS.		ACS.		ACS.		ACS.		ACS.		ACS.		ACS.		ACS.		ACS.
							AIYALUR RANGE.														
1 Mungilkaradu	Commercial	..	60	..	57	..	58	..	56	..	56	..	57	..	60	..	58	..	59	..	61
2 Thopaswamimalai Central.	Do.	..	95	..	97	..	98	..	97	..	103	..	95	..	96	..	96	..	95	..	97
3 Thopaswamimalai South	Do.	..	91	..	93	..	88	..	87	..	87	..	91	..	90	..	90	..	89	..	89
4 Thopaswamimalai North	Do.	..	72	..	74	..	76	..	76	..	73	..	76	..	72	..	75	..	73	..	73
5 A. Kombai	Do.	..	73	..	72	..	66	..	66	..	65	..	78	..	77	..	77	..	78	..	79
6 Panjanthangi	Do.	..	53	..	53	..	54	..	55	..	52	..	53	..	55	..	56	..	53	..	50
7 Shorimalai	Do.	..	63	..	58	..	57	..	55	..	52	..	55	..	57	..	60	..	58	..	61
8 Kaluvadimalai	Do.	..	78	..	73	..	72	..	74	..	72	..	69	..	69	..	68	..	70	..	70
9 Pillayarnatham North	Do.	..	76	..	76	..	77	..	76	..	75	..	77	..	74	..	74	..	74	..	78
10 Pillayarnatham South	Do.	..	52	..	54	..	50	..	51	..	52	..	51	..	50	..	54	..	54	..	53
11 Pannamalai	Do.	..	62	..	61	..	66	..	65	..	67	..	66	..	62	..	65	..	63	..	65
12 Sendurai	Do.	..	82	..	84	..	76	..	75	..	74	..	81	..	69	..	77	..	79	..	84
13 Mudimalai	Do.	..	56	..	57	..	61	..	57	..	62	..	58	..	57	..	61	..	58	..	56
14 Kumarikatty	Do.	..	132	..	134	..	123	..	122	..	124	..	125	..	128	..	125	..	122	..	125
15 Karpur Reddipatty	Do.	..	90	..	91	..	93	..	90	..	93	..	85	..	84	..	87	..	90	..	93
16 Mogavanur	Do.	..	100	..	98	..	99	..	100	..	100	..	100	..	100	..	98	..	96	..	100
17 Semmalai	Do.	..	99	..	98	..	100	..	97	..	102	..	102	..	101	..	103	..	99	..	101
18 Sorupam	Do.	..	109	..	106	..	107	..	107	..	106	..	106	..	107	..	105	..	107	..	107
19 Viramalai East	Do.	..	109	..	108	..	110	..	109	..	110	..	110	..	106	..	107	..	108	..	109
20 Viramalai West	Do.	..	108	..	108	..	109	..	106	..	110	..	106	..	108	..	110	..	111	..	110
21 Puthanatham	Reserve	I	22	II	22	III	22	IV	22	V	22	VI	21	VII	21	VIII	22	IX	21	X	2
							KODAIKANAL RANGE.														
1 Agamalai	Commercial	..	23	..	23	..	23	..	23	..	23	..	23	..	23	..	23	..	24	..	26
2 Amburuvi	Do.	..	61	..	59	..	63	..	63	..	63	..	63	..	63	..	53	..	53	..	53
3 Pambar	Do.	..	85	..	63	..	63	..	66	..	60	..	66	..	68	..	66	..	66	..	66
4 Adukkam	Do.	..	56	..	54	..	56	..	55	..	55	..	55	..	55	..	53	..	55	..	58
5 Murugamalai	Do.	..	40	..	40	..	39	..	40	..	40	..	39	..	42	..	43	..	42	..	42
6 Iruttar	Do.	..	50	..	49	..	52	..	49	..	50	..	52	..	53	..	50	..	52	..	50
7 Sadayaperumal	Do.	..	35	..	35	..	50	..	50	..	44	..	43	..	43	..	43	..	43	..	43
8 Mankaradu	Do.	..	39	..	40	..	40	..	40	..	40	..	39	..	40	..	39	..	39	..	40
9 Poombarai	Reserve	Dead fuel removal.		Dead fuel removal.		I	1·97	II	1·97	III	1·83	IV	1·84	V	1·84	VI	1·84	VII	1·84	VIII	1·80
10 Gundan Shola East	Do.	I	3·93	II	4·05	III	3·68	IV	3·78	V	3·88	VI	3·88	VII	3·83	VIII	3·78	IX	3·78	X	3·88
11 Gundan Shola West	Do.	I	4·36	II	4·31	III	4·36	IV	4·31	V	4·41	VI	4·41	VII	4·41	VIII	4·51	IX	4·51	X	4·46
							PALNI RANGE.														
1 Virupakshi South	Commercial	..	85	..	85	..	84	..	85	..	84	..	88	..	87	..	88	..	89	..	86
2 Palni	Do.	..	66	..	66	..	66	..	66	..	66	..	70	..	70	..	68	..	67	..	69
3 Virupakshi North	Reserve	III	29	IV	28	V	27	VI	29	VII	29	VIII	31	IX	30	X	29	XI	28	XII	31
4 Chatrapatti	Do.	I	30	II	29	III	30	IV	28	V	29	VI	30	VII	28	VIII	27	IX	28	X	30
5 Athicombai	Do.	I	21	II	21	III	21	IV	21	V	21	VI	20	VII	26	VIII	21	IX	24	X	26
6 Ayyampalayam	Do.	I	21	II	23	III	23	IV	19	V	19	VI	21	VII	19	VIII	20	IX	20	X	17
							CUMBUM RANGE.														
1 Kombai	Commercial	..	50	..	50	..	50	..	47	..	49	..	47	..	49	..	50	..	51	..	49
2 Pudupatty	Do.	..	50	..	49	..	51	..	51	..	55	..	50	..	51	..	51	..	50	..	50
3 Machakkal	Do.	..	47	..	47	..	45	..	62	..	61	..	58	..	59	..	60	..	58	..	62
4 Suranganar	Do.	..	76	..	79	..	77	..	78	..	76	..	77	..	77	..	78	..	77	..	77
5 Surulipatty	Do.	..	64	..	63	..	87	..	87	..	78	..	80	..	80	..	80	..	80	..	76
6 Vannathiparai	Reserve	I	68	II	66	III	69	IV	66	V	66	VI	64	VII	71	VIII	71	IX	71	X	71

CHAPTER V.—WORKING PLAN FOR THE BRAKEPOLE WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

592. This Working Circle is constituted for the supply of brakepoles for bullock carts going down the Kodaikanal ghat road with hill produce (coffee and plantains mainly) and is chiefly a safety device for the purpose of preserving the forest from illicit removals of this produce.

593. A reference to Chapter III of Part I will show that coffee, plantains and cardamoms are being grown in considerable quantities on the Lower Palnis. These hill products are being transported down to the plains in country carts, along the Kodaikanal ghat road. Failure to supply brakepoles in a legitimate manner is bound to result in illicit removals and for this reason the forest department has been supplying this need for the last 15 years at least. It is now proposed to regulate the exploitation of brakepoles so as to ensure a sustained supply from areas near the centre of demand and within a resonable distance of the ghat road. The annual supply has been about 800 brakepoles for the last ten years: provision will be made for expanding this supply up to a maximum of 1,000 poles per year.

594. The vegetation is of the mixed deciduous type, the chief tree species being *Anogeissus latifolia*, *Shorea talura*, *Mallottus philipinensis*, *Pterocarpus marsupium*, *Dalbergia latifolia* and *Dalbergia paniculata*, *Grewia sp.*, *Bridelia retusa* and an occasional teak: sandal seedlings and saplings occur in patches. The trees often attain a height of some 50 feet. The slopes are moderately steep and grass forms the undergrowth in most places.

595. The Working Circle will extend over an area of about 700 acres in the Palni Hills Southern Slopes R.F. along both sides of the Kodaikanal ghat road, between Tum-tum-parai and the Mulaiyar enclosure.

SECTION 2.—METHOD OF TREATMENT.

596. *Silvicultural system.*—The scheme that prevails now aims at the exploitation of a sufficient number of selected trees over a demarcated coupe to yield the required number of brakepoles for the year. It may be called a ' selection ' system, under which suitable trees, distributed in units all over the coupe, are exploited to a maximum limit of about 4 trees to the acre. The stools were expected to throw out coppice shoots and so replace the removals, but it is observed that they have either failed to coppice or that the shoots produced are lacking in vigor. This is understandable under the insufficient light conditions attendant upon the system. Also, there has not been any attempt to replace artificially what has been removed.

In order to remedy these shortcomings, it is prescribed that the existing system be modified so that the trees to be removed may be marked *in groups* instead of individually. This is expected to create gaps of sufficient size to induce vigorous coppice shoots from the stools resulting from fellings and which will admit of successful artificial regeneration by ' rab ' sowings.

597. *Felling cycle.*—A felling cycle of 20 years will be adopted : this is purely arbitrary. There will be only one felling series.

598. *Annual coupes.*—Experience from past working shows that from 120 to 160 trees yield about 800 brakepoles from an annual coupe of 30–35 acres. This works out to an average of 4 trees per acre. The removal of about five trees per acre is not likely to prejudice the factors of the locality, especially when it is followed by artificial regeneration. this will also provide for expanding the output to 1,000 poles per year. The annual coupes will therefore be about 35 acres in extent.

SECTION 3.—METHOD OF EXECUTING THE FELLINGS.

599. *Demarcation.*—The coupe of the year will be laid out on the ground from the map and demarcated by means of cut lines and surveyed by the Range Officer. This should be done in advance of the marking. Permanent demarcation will be secured by blazing the trees on both sides of the coupe lines and by means of wooden signboards nailed on to trees along the road margin, engraved with the numbers of the coupes.

600. *Marking.*—The trees to be felled will be marked by a competent officer not below the rank of a Forester, and checked by the Range Officer. The following rules will be observed in marking :—

(1) Trees of the undermentioned species shall not be marked :—Teak, *Dalbergia latifolia* , *Pterocarpus marsupium*, *Shorea talura* and sandalwood.

(2) Trees not saleable at the scheduled rate as breakepoles shall not be marked.

(3) Of the saleable species, softwoods like *Dalbergia paniculata* and *Melia dubia* should receive preference over species like *Anogeissus latifolia* and *Grewia tiliaefolia*.

(4) Trees above a breast-height-girth of 4′ may not be marked unless they are dead, dying or hollow.

(5) Trees below a breast-height-girth of 1′ 6″ shall not be marked.

(6) Trees should as far as possible be marked in groups of 2 to 4 (depending on their crowns) so that each group may be felled together to create a gap of a minimum diameter of about 20 feet.

601. *Felling.*—The felling will be done departmentally or under departmental supervision, as and when the brakepoles are required. The stock of poles should not be allowed to dry up as they will lose in weight and as the bark is likely to peel off : both of these conditions will prejudice their sale value as brakepoles.

The trees should be felled as close to the ground as possible and care should be taken to see that the cut is clean so that the bark is not separated from the wood : this will ensure a good growth of coppice shoots.

602. *Disposal.*—It is recommended that the sale of brakepoles may be effected through a a commission agent instead of directly to the public, as the latter involves the appointment of a wholetime subordinate.

SECTION 4.—REGENERATION.

603. *Artificial Regeneration.*—It is proposed to make experiments in regenerating artificially the gaps created by the fellings for brakepoles. The method of regeneration by " rab " sowings appears to be well adapted for the purpose. The number of gaps to be regenerated each year will be ten : this work will continue for three years, when the position will be reviewed, and if it is found that sufficient regeneration is obtained by coppice regrowth or if it is found that the artificial regeneration is unsuccessful, it may be discontinued. Before a decision is arrived at the District Forest Officer should submit a report to the Conservator who will then pass orders in the matter.

604. *Choice of species.*—The species to be used for regenerating the gaps will be *Albizzia lebbek*, *Dalbergia latifolia*, *Pterocarpus marsupium* and *Shorea talura*.

605. *Soil preparation.*—The slash resulting from fellings will be piled up in the middle of each gap and burned thoroughly in the month of April. The pile may be about 3 feet high and should cover as large an area as possible. A hot, but not too intense, fire should be aimed at and care should be taken to see that the surrounding forest is not set fire to.

Advantage may be taken of the usual thunder showers to prepare, on the burnt area, patches, $1\frac{1}{2}' \times 1\frac{1}{2}' \times 6''$, at an approximate espacement of $6' \times 6'$. The patches must be staked.

606. *Dibbling.*—The patches will be dibbled in the month of June with the seeds of the species named above, on the outbreak of the south-west monsoon. Only one species will be dibbled in a patch : the centre patches will be reserved for the *Albizzia* and *Pterocarpus* since they demand more light than the *Dalbergia*.

Half the number of seeds in each patch will be dibbled to a depth of 2″ to 3″ and the other half in the usual manner : this is expected to help some of the seedlings to tide over any long breaks in the rains.

The fruit of *Shorea talura* should be dibbled fresh as soon as it is collected since it does not keep.

The quantities of seeds required being small, no details are furnished.

607. *Planting.*—Stump planting of *Dalbergia* and *Pterocarpus* should also be tried, as in most places this is found to be the best way of regenerating these species. For this purpose the subordinates will have to raise small nurseries.

608. *Casualties.*—Casualties will be replaced in September—October, on the outbreak of the north-east monsoon.

609. *Weeding and tending.*—The seedlings will be weeded and tended as necessary, at the discretion of the District Forest Officer. The beat subordinates ought to be able to look after this work without the help of paid labour. Some tending is likely to be required in the second year as well.

The Provincial Silviculturist should be consulted periodically on the conduct of the above operations.

SECTION 5.—CONTROL.

610. A Control Book, Record of Works, and a Regeneration Ledger are to be maintained for this Working Circle. Sample forms for the first two will be found in Appendix VI (*g*) and (*l*) ; the third is the same as that prescribed for the Selection Working Circle.

TABULAR STATEMENT OF FELLINGS—BRAKEPOLE WORKING CIRCLE.

KODAIKANAL RANGE.

Name of felling series.	Years.									
	1936–37.		1937–38.		1938–39.		1939–40.		1940–41.	
	C. No.	Area.	C. No.	Area.	C. No.	Area.	C. No.	Area.	C. No.	Area.
		ACS.		ACS.		ACS.		ACS.		ACS.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Brakepole felling series	IV	35	V	35	VI	35	VII	35	VIII	35

KODAIKANAL RANGE—*cont.*

Name of felling series.	Years.									
	1941–42.		1942–43.		1943–44.		1944–45.		1945–46.	
	C. No.	Area.	C. No.	Area.	C. No.	Area.	C. No.	Area.	C. No.	Area.
		ACS.		ACS.		ACS.		ACS.		ACS.
	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(29)	(20)	(21)
Brakepole felling series	IX	35	X	35	XI	35	XII	40	XIII	40

CHAPTER VI.—WORKING PLAN FOR THE BAMBOO WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE AND CHARACTER OF THE VEGETATION.

611. The Bamboo Working Circle comprises all areas in the division where bamboos are found in workable quantities. The chief bamboo areas are in the Palni, Kodaikanal and Cumbum ranges, the first range containing the largest area. In the Natham range bamboos are confined to the Periaruvi valley of the Alagar Hills R.F., where *Bambusa arundinacea* covers some 70 acres. There is no bamboo in the Sholavandan and Ayyalur ranges.

612. Both *Bambusa arundinacea* (Perumoongil, Mullu-moongil or Vari) and *Dendromamus strictus* (Siru-moongil) are known to occur but the former is mostly confined to banks of streams, at all elevations up to about 3,000', whereas the latter is not confined to stream banks and occurs usually between 1,500′ and 3,500′.

613. Generally speaking, except in the Palni range, extensive areas of *Bambusa* do not occur in the division. In the Cumbum range, bamboos occur along stream banks on the Surulupatti plateau, and are somewhat more widespread in the Vannathiparai valley: they are also found along most of the larger streams flowing eastwards from the Western Ghats.

614. In the Kodaikanal range, they are confined to the valleys of the Periyar, Varahanadi, Pambar, Selambar and Manjalar.

615. In the Palni range, however, they are more widely spread and occur largely in the Northern Slopes, East R.F., the Poombarai-Vilpatti valley; the Porundalur valley and in the valleys of Olianuthu and Kudiraiyar reserves. One characteristic feature of the bamboo areas of the Kudiraiyar Valley is the prevalence of a number of well grown trees of *Acacia leucophloea* among the bamboos (*Bambusa*) which otherwise form pure blocks of varying size.

616. The *Bambusa* in the Alagar Hills R.F., is of large dimensions, the culms often attaining a height of over fifty feet.

617. The total area of the Working Circle is 110,454 acres, distributed as follows :—

Palni range—48,162 acres.	Cumbum range—23,100 acres.
Kodaikanal range—39,122 acres.	Natham range—70 acres.

618. *Flowering of bamboos.—Bambusa arundinacea* appears to have flowered sporadically in the Cumbum valley some 6–7 years ago–a note in the current bamboo working scheme mentions 1928 as a year of general flowering—and young immature clumps are in evidence here and there. *Dendrocalamus* was observed flowering sporadically in the Kudiraiyar valley early in 1935.

SECTION 2.—ANALYSIS AND VALUATION OF THE CROP.

619. All bamboo areas have been stockmapped by ocular estimate. No detailed analysis of the crop appeared to be called for.

Bambusa and *Dendrocalamus* have been shown separately in the stockmaps, as far as possible.

SECTION 3.—METHOD OF TREATMENT.

620. *Silvicultural system.*—It will be apparent from paragraph 68, Chapter II of Part I, that bamboos were spread more widely over the division in the past than they are

at present, and that their gradual disappearance is mainly due to ruthless overcutting. This heavy overcutting still continues to prevail, especially where bamboos are not plentiful, and it must be strictly prevented in order to conserve a forest produce indispensible to the poor villager. No treatment which prescribes such methods as clearfelling of one-half of a clump will ensure the careful exploitation that is necessary for the continued existence and spread of this species in the division. Careful exploitation of the clumps in such a manner as to ensure their continued existence and growth will alone meet the situation.

621. *Felling series.*—The Working Circle will be divided into eight felling series in order mainly to distribute the annual centres of extraction (coupes) as widely as possible among the various centres of consumption, failing which illicit felling is inevitable for satisfying legitimate local demands.

622. The following statement exhibits the ranges in which the felling series are situated, their area (total and net bamboo-bearing areas) and their boundaries.

Range.	Felling series.	Area in acres. Total.	Area in acres. Net bamboo.	Boundaries.
Kodaikanal ..	Periyakulam Series.	22,438	980	*North*—Starting from the north-western corner of Amburuvi reserve the boundary runs eastwards along the northern boundaries of Amburuvi, Shengalvarayar and Pambar reserve forests, up to the north-eastern corner of Pambar reserve forest; *East*—Thence along the eastern boundary of Pambar reserve forest, to its south-easternmost corner; *South*—Thence westwards along the southern boundaries of Pambar, Karungal-Dhonimedu, Shengalvarayar and Amburuvi up to south-western corner of the last named reserve; *West*—Thence along the western boundary of the abovesaid reserve to the starting point.
	Devadanapatty.	16,684	1,150	*North*—Starting from the north-western corner of Adukkam reserve, the boundary runs eastwards along the northern boundaries of Adukkam and Southern Slopes reserves till the latter meets the Unjalnachi reserve forest and thence along the western, northern and eastern boundaries of the said Unjalnachi reserve forest till it meets the Southern Slopes reserve forest again. Thence along the northern boundary of the Southern Slopes reserve forest till it meets Moguladi peak, west of point 4,241; *East*—Thence in a southerly direction along the main spur, to Kodaikanal ghat road and thence along the said road to the outer boundary in the plains; *South*—Thence in a westerly direction along the southern boundary of Southern Slopes reserve and Adukkam reserve to the south-western corner of the latter reserve; *West*—Thence along the western boundary of the said reserve to the starting point.

Note.—Wherever Southern Slopes R.F. is mentioned it includes all blocks of Palni Hill Southern Slopes R.F., except Mankaradu.

Range.	Felling series.	Area in acres. Total.	Area in acres. Net bamboo.	Boundaries.
Cumbum ..	Vannathiparai Series.	14,500	2,150	*North*—Starting from the trijunction of Pandarathorai, Surulipatti and Puvathukaradu reserves, the boundary runs in a north-easterly direction along the common boundary of the two last named reserves and thence along the outer boundary of Surulipatti reserve forest up to where it meets the Ambukanai stream; thence along the upward course of the said stream up to where it cuts the common boundary of Kuthanachiar and Surulipatti reserves; *East*—Thence along the common boundary of the afore-mentioned two reserves in a south-westerly direction till it meets the hill top Talitirugimotai (5,219′) and thence in a southerly direction along the common boundary between the Vannathiparai reserve forest and the Estate of the India Tea Company, Limited, thence along the said common boundary up to point 5,340′ on the Travancore frontier; *South*—Thence along the Travancore frontier boundary to point 3,176′ situated about ¾ of a mile east of Kolaludimedu; *West*—Thence in a north-westerly direction along the ridge running up to Medagaranmettu hill top (3,251′); thence along the spur which descends northwards to the plains through points 2,440′ and 1,652′ to the rest-house at Vannathiparai; thence, from the said rest-house, along the footpath leading to Gudalur meeting the outer boundary at Cairn 75; thence eastwards along the outer boundary of Vannathiparai reserve forest towards the junction of the Boothakaradu reserve forest, thence along their common boundary to the trijunction with Pandarathorai and thence along the Suruli river bank (down course) to the starting point.

Range.	Felling series.	Area in acres. Total.	Net bamboo.	Boundaries.
Cumbum ..	Gudalur Series.	9,200	1,660	The whole of the Poriparai Valley in Vannathiparai reserve forest, the entire areas of Melgudalur and Suranganar reserves and small detached bits of Machakkal and Kombai reserves constitute the series. MAIN BLOCK. *North*—Starting from the trijunction point of Travancore State, Machakkal reserve forest and Suranganar reserve forest, near Sellakoiluchi (3,628′), the boundary runs eastwards along the common boundary of Suranganar and Melgudalur reserve forests till the latter meets the boundary of the Vannathiparai reserve forest and thence along its outer boundary to cairn No. 75 standing on the path leading from Gudalur to Vannathiparai rest-house; *East*—Thence along the said path to the rest-house at Vannathiparai and thence up the spur leading to Medagaranmettu hill top, up along the outer ridge, in a south-westerly direction to the Travancore frontier boundary at point 3,176′, about ¾ mile east of Kulaloodi medu; *South* and *west*—Thence along the Travancore frontier boundary up to the starting point. OTHER PORTIONS OF THE SERIES. (1) *Machakkal reserve forest*—(*a*) An area of 120 acres forming the two fuel coupes XX and XXI (old series) of Machakkal Series, (*b*) Ekaluthu, an area of 60 acres with scattered patches. (2) *Kombai reserve forest*—(*a*) *Cumbum mettu.*—A few clumps occupying five to six acres adjoining the Cumbum mettu path, (*b*) *Kattakan mettu*—Banks of the stream flowing down the mettu on both sides, 40 to 45 acres. (*c*) The valley of the Kanaluthu Odai, a patch of 3 to 4 acres. (*b*) Along the path leading from Kombai to Ramakkal.
Palni ..	Virupakshi Series.	15,793	5,150	*North*—Starting from north-west corner of Vennilai reserve forest the boundary runs along its northern boundary till it meets Northern Slopes reserve forest; thence along the northern boundary of the last named reserve up to the point where Parapalar crosses it; *East*—Thence along the said Parapalar up its course to the southern limit of Parapal enclosure. Thence up along a stream flowing into the said Parapalar till it meets the eastern boundary of Northern Slopes reserve forest; thence along the eastern boundary of the said reserve till it meets the Siruvathukadu reserve forest, thence along the common boundary between Siruvathukadu reserve and Ayakudi zemin up to the top of Marimalai (4,596′); *South*—Thence westwards along the southern boundaries of Siruvathukadu, Northern Slopes and Vennilai reserves up to the junction of the last with the Ayakudi zamindari at Shembamalai (Point 4,991′); *West*—Thence along the common boundary of Vennilai reserve forest and Ayakudi zamindari to the starting point.
	P.V. Valley Series.	17,590	2,250	This series consists of the whole of the P.V. Valley reserve. No boundary description, is, therefore appended.
	Kudiraiyar Series.	14,900	3,430	The whole of Olianuthu reserve forest and Kudiraiyar reserve forest in Madura division constitute this series. No boundary description of this series is therefore appended.
Natham ..	Alagar Hills Series.	70	70	....

623. *Felling Cycle.*—A felling cycle of three years is adopted, in accordance with the period generally recognized as most suitable to the exploitation of bamboos. Each felling series, with the exception of the Alagar hill series, is divided into three coupes one of which will be worked every year. The total area of the Alagar hill series is only 70 acres so that it is not desirable to subdivide it and it will be worked at triennial intervals. The coupes in a series are approximately equiproductive, and their boundaries follow natural features or existing lines—vide Management maps.

624. The following statement exhibits the gross and net areas of coupes in the various felling series :—

Statement showing the gross and net areas of coupes in the various felling series.

Range.	Felling series.	Coupes. Number.	Gross area in acres.	Net area in acres.
Kodaikanal	Periyakulam Series	I	10,771	400
Do.	Do.	II	4,608	350
Do.	Do.	III	7,059	230
Do.	Devadanapatti Series	I	5,984	300
Do.	Do.	II	5,800	450
Do.	Do.	III	4,906	400
Cumbum	Vannathiparai Series	I	5,600	200
Do.	Do.	II	6,600	920
Do.	Do.	III	2,300	1,030
Do.	Gudalur Series	I	4,200	1,020
Do.	Do.	II	2,000	270
Do.	Do.	III	3,000	370
Palni	Virupakshi Series	I	6,093	1,800
Do.	Do.	II	4,600	1,850
Do.	Do.	III	5,100	1,500
Do.	P.V. Valley Series	I	5,750	600
Do.	Do.	II	5,440	900
Do.	Do.	III	6,400	750
Do.	Kudiraiyar Series	I	7,900	980
Do.	Do.	II	3,200	1,250
Do.	Do.	III	3,800	1,200
Natham	Alagar Hill Series	..	70	70

625. *Method of executing the fellings.*—

(1) Young culms less than a year old shall not be felled under any circumstances.

(2) Culms more than a year old may be felled, provided that a *minimum* of six such culms shall be left in each clump.

(3) When a clump does not contain more than six mature culms (i.e., of more than one year old) no bamboo shall be extracted from it.

(4) Fellings shall be made (when possible) on the side of the clump opposite to that where the largest number of first year culms are found. For new culms are, in general, produced from that part of the clump where the rhizomes are most vigorous and it is desirable to preserve this part of the clump.

(5) The culm should be cut as low as possible, but above the internode next to the ground level.

(6) Culms shall not be removed with the rhizomes, for walking sticks, picottah shafts or other purposes.

(7) Immature clumps which have resulted from the flowering of 1928 shall not be worked till they start producing culms of mature size.

626. *Agency of fellings.*—The fellings will be through the agency of contractors.

627. *Period of contract.*—The period of the lease will normally be one year, during which time the fellings will pass over one coupe.

In the case of the Kudiraiyar series, we have an area of about 3,400 acres well stocked with bamboos which are now being worked only for local consumption owing to lack of proper extraction roads. With a fairly good cart-track running into the Kudiraiyar valley the bamboos could be profitably exported to Madura, which now obtains its supply from places as distant as Mettupalaiyam or Malabar. If the whole of this series be leased out together for a period of three years—one coupe to be felled each year—it is anticipated that contractors will be willing to construct the necessary road-system to enable the produce to be placed on the Madura market at a profit—a profit which we are bound to share later on. It is therefore suggested that the Kudiraiyar felling series should, in the first place, be put up to auction for a period of three years and the lessee allowed a voidah of three years to exploit it, on the strict condition that he should work the three coupes of the series, one per annum, in correct succession, during the three year period and that he should construct an extraction road on an alignment approved by the District Forest Officer. If the contractor desires it, indeed it would be to our advantage, if the Ranger were to align the road and this he might do free of charge. The District Forest Officer should further see that the contractor gets all the technical help that may be required from the department.

If the anticipated road system comes into existence as a result of this procedure not only will it raise the future price of the bamboo coupes in this series, but also it will help the

department to work the pole forests of the locality at a profit. On the other hand, for the department to construct these roads, on the chance that the benefits refeired to above would accrue subsequently, would be taking an unnecessary risk.

SECTION 4.—REGENERATION.

628. The reserves of the Madura division generally do not contain sufficient bamboo to meet local requirements fully, much less to supply the Madura market. There are ample signs that in some areas bamboo has been exterminated as a result of ruthless over cutting ; on the Karandamalais, for instance, a few miserable remains of *Dendrocalamus* may still be seen, from which the hill villagers have been able to develop respectable clumps in their private land. The bamboo is an indispensible material of general domestic utility for rich and poor alike, so that any steps taken towards making it available in larger quantities, and nearer to the centres of consumption, is bound to be remunerative in the long run.

629. Experimental planting of bamboos (both *Bambusa* and *Dendrocalamus*) conducted by the Working Plans Branch in 1933 (vide paragraph 345) has yielded results which are not discouraging : but for the persistent dry weather and damage by bison, the results would have been still more encouraging.

630. Before the planting up of extensive areas with bamboos may be prescribed, however, further experience has to be gained. For this purpose it is prescribed that, over one acre in each of the areas specified hereunder, bamboos (both *Dendrocalamus* and *Bambusa*) will be planted every year, for the next five years, as described below :—

(1) The areas for the experimental introduction of bamboos will be—
Dendrocalamus strictus in,
(*a*) Karandamalai plateau,
(*b*) The Thadaganachi plateau of the Sirumalais.
Bambusa arundinacea in,
(*c*) The Aiyangodai valley of the Karandamalais.
(*d*) The southern valley of the Alagar hills reserve.

(2) *Dendrocalamus* should be planted at elevations above 2,500′ in areas free from grass. Suitable localities are the semi evergreens fround near streambeds above this elevation ; but the planting should not be under the low shade of shrubs as the species is a strong light demander.

(3) *Bambusa* should be planted on either bank of the perennial streams flowing through the valleys named, up to a distance of one chain from the streambed. Low shrubs should be cut before planting out the bamboo.

(4) Rhizomes from young plants two to three years old and those from mature clumps may both be tried in equal proportions.

(5) The planting should be done in pits 2′ × 2′ × 1½′, in the south-west monsoon, if it be favourable ; otherwise it should be done early in the north-east monsoon. Casualties in the June planting should be replaced in the following October.

(6) An espacement of 12′ × 12′ should be adopted.

(7) Subsequent tending will be confined to cleanings, which should be made with the object of providing everhead light, as and when required.

(8) The experimental plots should be effectively fenced against cattle, without which no success can be anticipated. A useful fence can be cheaply constructed by piling brushwood and branches with their branchy ends projecting outwards and pressing them well down.

(9) The results should be recorded in Experimental Plot Files under instructions from the Provincial Silviculturist, who should be consulted for further details.

(10) The operation is estimated to cost about Rs. 7 an acre.

SECTION 5.—MISCELLANEOUS REGULATIONS.

631. *Fire protection.*—The Bamboo Working Circle will be protected from fire under the regulations prescribed for general fire protection, Chapter XI, Section 5.

632. *Statistics.*—A monthly account of all removals of bamboos shall be rendered to the District Forest Officer by the lessee, not later than the 15th of the subsequent month. Details must be furnished showing the outturn or removals under the different local bamboo classes, the rates charged by the contractor for each class of material, and the current sale rates.

633. The main "classes" of bamboos extracted in Madura division are—

Main classes of bamboo extracted in Madura division.

Species.	Local name.	Description.	Remarks.
Bambusa arundinacea.	Vari	12 cubits or 18 feet long, bottom portion, 3 inches diameter and below.	Removed in headloads of 4.
Do.	Kalas	Top ends, 9 cubits or 13½ feet long.	Removed in headloads of 12.
Do.	Ettumula kattai.	8 cubits or 12 feet long and diameter of and below 2 inches.	Removed in headloads of more than five.
Do.	Arumula kattai ..	6 cubits or 9 feet long	Do.
Do.	Debbai kattu (Splits).	In bundles of 25, width 1½ " to 2" and length 12 feet.	
Do.	Savari kattai ..	Big size, solid bottom, about 3½ cubits or 5 feet length.	Tie piece for bullock carts.
Do.	Varai ..	Hollow, 15′ to 30′ length, minimum diameter of 3 ".	This kind of material is most in demand in Cumbum Valley.
Bambusa and *Dendrocalamus.*	Sattai kuchi (Whip sticks).	For whips	
Do.	Pandal tharam ..	7 feet or more in length and over 3" girth at bottom.	In bundles of ten or more.
Dendrocalamus strictus.	Sirumungil Debbai.	Splits with outer skin, to the maximum length of bamboos available. No limit of number in each bundle.	This produce is usually removed by medakars, the caste which make baskets, etc.

SECTION 6.—CONTROL.

634. A Control Book, and Record of Works in the forms shown in Appendix VI (*k*) and (*l*) shall be maintained. A summary of the operations in the Working Circle will be entered in the Control Book for the financial year, along with the outturn. The Record of Works should exhibit the Regeneration operations prescribed.

It is again emphasised that a strict and careful control of bamboo fellings is imperative if the continued existence of bamboos in the division is not to be jeopardized.

Tabular statement of fellings—Bamboo Working Circle.

Serial number and name of felling series.	Year.									
	1936–37.	1937–38.	1938–39.	1939–40.	1940–41.	1941–42.	1942–43.	1943–44.	1944–45.	1945–46.
	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.
Cumbum range—										
1 Vannathiparai series ..	I	II	III	I	II	III	I	II	III	I
2 Gudalur series (*a*)	..	I	II	III	I	II	III	I	II	III
Kodaikanal range—										
1 Periyakulam series	I	II	III	I	II	III	I	II	III	I
2 Devadanapatti series ..	I	II	III	I	II	III	I	II	III	I
Palni range—										
1 Virupakshi series	I (*b*)	II (*c*)	III	I	II	III	I	II	III	I
2 P. V. Valley series	I	II	III	I	II	III	I	II	III	I
3 Kudiraiyar series	I	II	III	I	II	III	I	II	III	I
Natham range—										
1 Alagar hills series	Whole area.	..	..	Whole area.	..	..	Whole area.	..	..	**Whole area.**

(*a*) Work in this series to be started only in 1937–38. (*b*) Worked in 1935–36. Portion in Vennilai Reserve Forest in the coupe will be excluded for 1936–37. (*c*) Portion of North slopes Reserve Forest worked in 1935–36 to be excluded for this year only.

CHAPTER VII.—WORKING PLAN FOR THE SANDAL WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE WORKING CIRCLE AND CHARACTER OF THE VEGETATION.

635. The Sandal Workihg Circle includes all areas in the reserved forests of the division in which sandal trees have been found to occur naturally and all localities in which it is considered desirable to introduce the species artificially.

636. Sandal occurs naturally (1) in the Unjalnachi, Marudanadiar and the Palni Hills Southern Slopes reserves of the Lower Palnis, in the neighbourhood of Pulathur and Mulaiyar villages, (2) round about the village of Pachalur in the Palni range, (3) in the Sathiar Valley and on the northern slopes of the Sirumalais, in the Sholavandan range, (4) on the Karandamalai and Perumalai plateaux of Natham range and (5) in the Kombai reserve of the Cumbum range. The total area covered by natural sandal in the division is about 2,740 acres as computed from stockmaps prepared for this Working Plan.

637. Localities considered suitable for the artificial introduction of sandal are, (1) the Karandamalai and the Perumalai plateaux and the tops of the Alagar hills in the Natham range, (2) the Sirumalai plateau of the Sholavandan range and (3) the Parapal plateau and the lower slopes of the Kudiraiyar block, in the Palni range.

638. The Karandamalai plateau, the tops of the Alagar hills and the Sirumalai plateau (elevation 2,000'— 3,000') were included in a " Timber Working Circle " under Mr. Wilson's Fuel Working Plan, but were not worked to any considerable extent owing, partly, to want of facilities for extraction. These areas are not likely to be worked for fuel for a long time to come as the demand for fuel in the town of Madura can be met from sources easier of exploitation. Also, they contain considerable quantities of *Shorea talura* suitable for growing lac if and when this industry can be expanded. The experimental cultivation of lac on *Shorea talura* on the Karandamalais has been prescribed under the " Lac Working Circle " in Chapter IX of Part II. These forests support an open pole type of forest conducive to the growth of sandal.

639. The Parapal plateau of the Palni range also lies between 2,000' and 3,000' and contains a poor open type of jungle, the result of shifting cultivation in the past. That part of the plateau which is not accessible for fuel working has been allotted for sandal propagation, for which it is eminently suitable.

640. The lower slopes (2,000' — 3,000') of the Kudiraiyar block in the Palni range support a pole type of forest of a somewhat better quality than what may be found on the Karandamalais, together with bamboos. There are no roads to facilitate their intensive exploitation. There are also a number of perennial streams which make the locality particularly suited to sandal propagation.

641. The species generally met with in this Working Circle are, *Anogeissus latifolia, Shorea talura, Buchanania latifolia, Pterocarpus marsupium, Dalbergia latifolia, Grewia sp., Randia dumetorum* and *Zizyphus xylopyrus*. Occasionally, teak and *Terminalia chebula* may also be found. Bamboo occurs in the Kudiraiyar valley and on the Palni hills.

642. The total area of the Sandal Working Circle is 16,000 acres, out of which only 2,740 acres are actually sandal bearing, the rest being, however, suitable for stocking with sandal.

SECTION 2.—ANALYSIS AND VALUATION OF THE CROP.

643. Though sandal was noticed in 1863 round about Pulathur on the Lower Palnis, very few trees above a breast-height-girth of 24 inches exist anywhere in the division. The majority of the trees, in all localities, are below 18 inches in girth at breast height. Very few dead or dying trees containing appreciable heartwood have been observed.

644. All sandal trees in the division were enumerated by the district staff between 1929 and 1931 : the result is tabulated below :—

Range.	Reserve.	Locality.	Total number of trees.	Remarks.
Kodaikanal ..	Southern slopes reserved forest.	Whole reserve	2,736	Enumerated in 1929. All trees above 2 inches girth.
Palni ..	Unjalnachi ..	Do.	3,494	Enumerated in 1931. All trees over 6 inches in girth.
Cumbum ..	Kombai Reserve Forest.	Vellaparai	1,484	Enumerated in 1931. All trees over 6 inches girth.
Do. ..	Do.	Coupes III to V. (Kombai series.)	142	Enumerated in 1930. All trees over 6 inches girth.
Do. ..	Do.	Coupes XVI and XVII. (Kombai series.)	13	Do.
Sholavandan.	Sirumalai Reserve Forest.	Sathiar	458	Enumerated in 1931. Trees over 6 inches girth.
Do. ..	Do.	Sirumalai upper slopes. (Malayur side.)	2,242	Enumerated in 1931. Trees over 6 inches girth.
Do. ..	Do. North-west slopes.	Endlaparai, west of bridle path.	120	Do.
Do. ..	Sirumalai Reserve Forest and S. North-east Reserve Forest.	Whole of Sirumalai lower slopes including North-east Reserve Forest.	2,082	Enumerated in 1931. Trees over 6 inches girth.
Natham ..	Karandamalai ..	Kanavaipatti beat ..	350	Enumerated in 1929. Over 3 inches girth.
Do. ..	Do. ..	Kuttupatti beat ..	165	Enumerated in 1929. Over 3 inches girth.
Do. ..	Perumalai	Malayur	573	Enumerated in 1929. 1 inch and over.
Do. ..	Alagar hills	Near temple and in Periaruvi valley and at Trundikal odai.	71	Do.

645. All sandal bearing areas in the division were stockmapped at the time of field work for this Working Plan. Since no appreciable yield of sandal is anticipated within the next ten years, the trees being of sizes too small to produce saleable heartwood, no enumerations were conducted. The results of the enumerations made by the District Staff, tabulated above, give a sufficiently accurate idea of the stock for the purpose of this plan.

SECTION 3.—METHOD OF TREATMENT.

646. It has been mentioned above that the sandal trees in the division are of small dimensions and that very few dead trees containing appreciable heartwood are met with. It is therefore not proposed to prescribe any elaborate system for the exploitation of sandalwood. What is obviously the primary need in the near future is to protect the existing and future stock of trees and to tend them. Exploitation will be limited to the departmental collection of all dead trees met with during the course of such tending, which contain heartwood of the minimum diameter of a rupee. Detailed instructions regarding the exploitation of sandal are contained in an official pamphlet entitled "Rules regarding selection, felling, cleaning, classification and disposal of sandalwood and the method of maintaining depot accounts and other registers." These rules should be followed, as far as they apply, but for the small quantity of sandalwood that is likely to be concerned the procedure may be cut down to the minimum required.

SECTION 4.—SUBSIDIARY SILVICULTURAL REGULATIONS.

647. *Tending.*—It has been stated in the previous section that the primary need in the near future is the tending and protection of the existing and future sandal trees in the division. Tending of sandal is indispensible to its proper development; when the plant has grown into a sapling it requires overhead light; as a seedling it needs to be protected from the sun and from browsing animals. Also, sandal, being a root parasite, requires to be in close proximity to its hosts all through its life. The tending of sandal therefore calls for considerable attention and care from officers entrusted with that work. The following rules are intended as a guide for the execution of proper tending :—

(1) Leave all seedlings (plants below 2 feet in height) well alone.

(2) Trees or plants which serve, or might serve, as hosts to the sandal but which interfere with its external growth, may be pollarded or coppiced as necessary, but may not be destroyed.

(3) In the case of saplings (trees less than about nine feet high) whose crowns are within easy reach of browsers, do not destroy any bushes that may exist on the sides, but free the tops. The aim should be to create a sort of chimney, the sapling being closed in on all sides by bushes and exposed to the sun at the top. All overhanging branches which shade the sandal should be cut: all small trees which suppress it must be cut back and coppiced. The slash and thorns resulting from such tending must be piled up in the form of a fence round the sandal.

(4) All climbers on sandal trees should be destroyed, poisoned, if possible, by the methods recently described by the Provincial Silviculturist.

(5) In the case of trees beyond the reach of browsers, such steps should be taken as will expose the crown completely to the sun.

(6) All sandal trees whose main stems are broken should be cut back, if they are not too old to throw out coppice shoots. The cut stem should be taken to stock if found to contain any scented wood.

648. *Tending cycle.*—It is the primary duty of the beat subordinates to tend personally as many sandal plants as possible every time they go into the sandal area. That timely help which may make or mar a plant can be secured more effectively by constant supervision than by the periodical attention that is necessarily involved in the prescription of a tending cycle. But intensive attention over wide areas can only be attained by prescribing regular tending operations as often as practicable.

A tending cycle of three years is, therefore, prescribed.

649. *Regulation of tending.*—The total sandal bearing area of 2,740 acres is divided into six series.

1	Kodaikanal range	6 coupes	1,140 acres.
2	Palni range	2 ,,	510 ,,
3	Cumbum range	1 coupe	180 ,,
4	Sholavandan range	3 coupes	840 ,,
5	Natham range	1 coupe	70 ,,

Each series has been divided into a convenient number of coupes, varying from one to three. The areas of the coupes have been fixed with reference to the extent that may be attended to efficiently in one year. Each of these coupes will be tended intensively once in three years on the lines indicated above.

The following tabular statement exhibits the tending series, the coupes and their area :—

Tending series.	Total area in acres.	Coupes. Number.	Coupes. Area in acres.	Location of coupes.
Kumbrakad Series (Kodaikanal range).	595	I	205	The sandal area in Keevalam and the two bits to the east and west of Pallangi.
		II	220	The portion in the main block to the west of the Iruttar stream.
		III	170	The portion in the main block to the east of Iruttar and west of the stream lying within two furlongs east of point 4,103′ (Approximately).
Pulathur Tending Series (Kodaikanal range).	545	I	190	The portion between the stream forming the eastern boundary of Coupe III of Kumbrakad Series and the stream, Kudirakal Odai, lying just to the north of point 4,241′ near Mogiladi.
		II	175	The portion between Kudirakal Odai and the ridge descending from Periyamalai to Kudirakalteri.
		III	180	The remaining portion of sandal area to the east of the ridge described above.
Palni range	510	I	260	The whole of Unjalnachi reserve forest and the portion in the northern slopes reserve forest.
		II	250	The whole area in Marudanadiar reserve forest.
Cumbum range	180	I	180	Both Vellaparai area and the coupes in Kombai fuel series.
Sholavandan range	840	I	320	The portion in the Konapatti series and the portion in the main block in the Endlaparai series lying to the east of the ridge going up from point 1,792′.
		II	290	The remaining portion in Endlaparai series and the small portion to the west of the bridle-path leading up to the Sirumalai plateau.
		III	230	The portion in the Sirumalais lying all along the Ammayanakanur boundary near Malayur and the area in Sathiar reserve forest.
Natham range	70	1	70	50 acres in Karandamalais reserve forest and 20 acres in Perumalai reserve forest.

Fire Protection.

650. The Vellaparai sandal area at Kombai in the Cumbum range is being specially fire protected now, by means of a cut and burnt line 50 feet broad and three miles long all round it. The locality is subject to almost annual fires and it is therefore prescribed that this special protection of the sandal area shall be continued. The sandal in the fuel series is not subject to fire and needs no special fire protection.

651. The main sandal area in the Natham range is on the Karandamalais. Proposals for the fire protection of the Karandamalai plateau will be found in Chapter XI, under general fire protection. No other special protection is necessary.

652. The main sandal areas in the Kodaikanal and Palni ranges are round about the villages of Pulathur, Mulayar, Kumbarai and Pachalur and on both sides of the Kodaikanal ghat road. The firetracing of both sides of the ghat road is prescribed in Chapter XI as a measure of general protection : this will serve the sandal areas also. For areas round the villages, the *immediate* closure of burnt areas to grazing recommended in the chapter on general fire protection, is expected to provide the required safety.

653. In the Sholavandan range, sandal in the Endlaparai fuel series and in the Sathiar Valley is not very susceptible to fire as it occurs mostly on flat ground and in fuel areas. The sandal on the higher Sirumalai slopes is subject to this danger however. This area comes under general fire protection, under which the Dindigul-Sirumalai bridle path, the Ammayanayakanur zamin boundary and certain footpaths leading up to the Sirumalai plateau are firetraced.

654. Propagation centres should be protected against fire by scraping clean a belt ten feet wide round each centre.

655. *Grazing.*—All sandal areas in the division are at present closed to grazing. This procedure should be continued but notice boards indicating such closure should be exhibited more freely.

Artificial regeneration—Formation of propagation centres.

656. The artificial propagation of sandal will be effected by means of small fenced beds in which seeds of sandal will be dibbled. The object is to raise a few healthy sandal trees in suitable places which will later on serve as mother trees to spread the species naturally in the locality.

657. The following prescriptions should be followed in the creation of propagation centres :—

(*a*) *Choice of site.*—(i) No propagation centres shall be made in areas above an elevation of 4,000 feet.

(ii) No propagation centres shall be made in any fuel series constituted under this plan.

(iii) Propagation centres shall be made in areas where conditions for the subsequent natural spread of sandal are good, e.g., by banks of streams, where the seed is likely to be spread by birds and by floods. Banks of streams which contain some water in the hot weather are particularly suitable, as seedlings can then be watered easily if necessary. Propagation centres are unnecessary in areas which already contain sandal.

(iv) Propagation centres should be located under light overhead shade, but sholas or semisholas should be avoided, as they are unsuitable for the spread of sandal. Protection from the afternoon sun is particularly desirable. These centres may be selected then in the centre of clumps of small trees or shrubs or to the east or north-east of standing trees. Open or grassy areas are generally unsuitable.

(*b*) *Size of the propagation centres.*—The size of a centre may vary from $10' \times 10'$ to $15' \times 15'$.

(*c*) *Soil preparation.*—The area selected should be completely cleared of all growth and the resulting slash heaped up and burned thoroughly on it. The ash should be raked well into the soil. Shallow saucer-like pits should be made at two feet intervals and filled with good loamy soil, leaving a margin of about 2 feet round the inside of the fence. These operations may be completed by the middle of May.

(*d*) *Fencing.*—A stout fence not less than 5 feet high should be erected round the centre, a stile being made to provide ingress. The fence should be so constructed as not to impede the free circulation of air at ground level. It should be kept in repair for a minimum period of six years. Standing trees may best be used as the uprights in constructing this fence, if they occur at suitable intervals.

(*e*) *Seed collection.*—Sandal fruits should be collected from healthy mother trees marked beforehand. The ground round the mother trees should be cleared all round and sound ripe fruits gathered from the ground in March-May. Immediately the fruits are collected, they should be immersed in water and stripped of their pulpy covering and the seeds dried under shade. Seeds of the previous year should not be used for dibbling.

(*f*) *Sowing.*—About ten selected sandal seeds should be placed in each saucer-like pit, so that the seeds are touching one another and pressed down level with the top of the soil. Some straw should then be lightly packed in each ' saucer ' over the seeds and thoroughly wetted. A heavy stick should be placed over the straw to prevent it from being blown away. In order to provide temporary hosts for the young sandal seedlings, the entire area of the centre, with the exception of the sandal patches, should be sown up with the seeds of suitable temporary hosts, shrubs, and not tree species, being used for this purpose. The following are recommended :—

(1) *Dodonœa viscosa*,
(2) *Cassia tora*,
(3) *Scutea indica*,
(4) *Acacia farnesiana* and
(5) *Cajanus indicus* (dhall).

All this sowing work should be done in the middle of May, and should be repeated in the middle of September in case of poor results.

Unless there is adequate rainfall after the sowings, the beds should be watered if possible, at least once a week, till germination is satisfactory. Watering may be continued sparingly after germination if there be a prolonged drought.

(*g*) *Casualties.*—Each subordinate who is responsible for the maintenance of propagation centres should raise at his quarters a number of sandal seedlings combined with suitable hosts, in small bamboo baskets. These baskets containing the sandal and the hosts should be planted out entire at the beginning of the North-east Monsoon to replace casualties in the propagation centres. Basket planting will have the best chance of success if done in pits $1\frac{1}{2}' \times 1\frac{1}{2}' \times 1'$. This may be the method which is most likely to yield practical results in localities where water is scarce in the hot season. Experiments with stump planting sandal have also given good results and should be tried experimentally.

(*h*) *Tending.*—The seedlings should be thinned as necessary. After the saplings have established themselves overhead light should be let into the centres.

(*i*) All propagation centres in a beat should be serially numbered. This number, together with the dates of sowing and resowing should be written clearly in tar on an adjacent tree.

658. Propagation centres should be made every year in the undermentioned beats by the Forest Guards and Watchers in charge. The actual sites for the centres should be selected by the Range Officer or if possible, to begin with, by the District Forest Officer, for the first two or three years, after which the beat subordinates should be able to make their own selections. The sites selected should, when this stage is reached, be approved of by the Range Officer, after inspection. At least five centres shall be made every year in each of the beats named below :—

Localities suitable for Sandal propagation centres.

Range.	Beat.	Reserve.	Locality.	Extent.
(1)	(2)	(3)	(4)	(5)
				ACS.
1 Palni	Kottavali	Siruvathkad	Round the enclosure	700
2 Do.	Virupakshi	North Solpes Reserve Forest.	Round Mattupatti kadu	600
3 Do.	Dasaripatti	Do.	Round Yelraiparai kadu	450
4 Do.	Kavalpatti	Kudiraiyar	Along stream banks	1,500
5 Do.	Periyur	North Slopes Reserve Forest.	Round Talayuthu kadu	200
6 Do.	Pachalur	Do.	Along path to Pachalur from Virupakshi.	200
7 Natham	Uduppukudi			
8 Do.	Kuttupatti			
9 Do.	Manakattur	Karandamalais	In the plateau above fuel series limits, along stream banks and *adjacent* to sholas.	4,700
10 Do.	Senkurichi			
11 Do.	Kanavaipatti			
12 Do.	Vemburli			
13 Do.	Arukkampatti			
14 Do.	Munnur	Alagarhills	Along stream banks and in areas excluded from fuel series.	1,340
15 Do.	Alampatty			
16 Do.	Kasampatti			
17 Do.	Lingavadi	Perumalai Reserve Forest.	Southern extremity of enclosure, near tank, inside Reserve Forest.	70
18 Sholavandan.	Malayur	Sirumalai	Madagamalai	200
19 Do.	Sirumalai South	Do.	Tadaganachi valley	1,800
20 Do.	Valayapatti	Do.	Kunthalam-kodai valley and the plateau up to the zamin limits.	
21 Do.	Anjukulipatti	Do.	West and south of Anjukulipatti path up to zamin limits.	1,500

659. *Control.*—The following control forms will be maintained at the District Forest office :—

(1) The Record of Works.

(2) The Journal of Propagation centres. Sample forms will be found in Appendix VI (*e*) and (*i*).

The exact location of propagation centres shall be marked on tracings of Survey of India sheets and the maps filed with the journal.

Tabular statement of tending operations.

Sandalwood Working Circle.

Name of series.	Years.									
	1936–37.	1937–38.	1938–39.	1939–40.	1940–41.	1941–42.	1942–43.	1943–44.	1944–45.	1945–46.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Coupe number.	Coupe number.	Coupe number.	Coupe number.	Coupe number.	Coupe number.	Coupe number.	Coupe number.	Coupe number.	Coupe number.
Sholavandan	I	II	III	I	II	III	I	II	III	I
Natham	I	..	..	I	..	..	I	..	..	I
Cumbum	I	..	..	I	..	..	I	..	..	I
Kodaikanal—										
Kumrakad	I	II	III	I	II	III	I	II	III	I
Pulathur	I	II	III	I	II	III	I	II	III	I
Palni	I	II	..	I	II	..	I	II	..	I

CHAPTER VIII.—WORKING PLAN FOR THE MINOR FOREST PRODUCE WORKING CIRCLE.

SECTION 1.—GENERAL CONSTITUTION OF THE CIRCLE.

660. The Minor Forest Produce Working Circle covers the whole of the Madura forest division which includes the revenue district of Madura and the Trichinopoly, Karur, Lalgudi and Kulittalai taluks of the Trichinopoly district. The prescriptions framed in this chapter will apply to the farming of all the minor produce occurring within the Working Circle, with the exception of lac, sandalwood and bamboos, which have been dealt with separately.

661. An experimental plantation of *Eriodendron anfractuosum* will also be prescribed in order to gauge the possibilities of the production and sale of the floss of this species, known to commerce as 'Kapok.'

662. The undermentioned areas will be excluded from the Working Circle :—

(1) All reserves and unreserves under panchayat management.

(2) Lands under the control of the Public Works Department.

(3) Channel banks of the Rajavaikal and Nanjakalkurichi in the Karur taluk.

(4) The whole of the Periyar delta below Peranai.

(5) Areas leased for cardamom cultivation, only so far as cardamoms are concerned.

(6) Village sites, burial and burning grounds, threshing floors, cattle and cart stands, temple squares (except jungle shrines) and paracheries.

(7) Other specified areas of small extent, such as areas leased for coffee or plantains, which will be notified in the sale notices from time to time, only so far as the produce for which they have been leased are concerned.

663. The Working Circle is divided into farms the jurisdiction of each of which is based partly on the forest range and partly on the kind of produce to be farmed : details will be found against the kind of produce concerned.

SECTION 2.—METHOD OF TREATMENT.

664. Of the various kinds of minor forest produce occuring in the division, gallnuts (fruits of *Terminalia chebula*), Avaram bark (bark of *Cassia auriculata*) and tamarind (fruits of *Tamarindus indica*) are economically the most important. The first two are now being leased out separately, but tamarind is at present included in the general list of produce sold together. It is understood that the contractor who takes the lease of all the minor forest produce sold together in a range is generally in the habit of sub-letting to others the right of collecting tamarind over specified localities. It is therefore apparent that we have not been in direct touch with the wholesale dealer in tamarind. We shall not be in a position to assess truly the economic possibilities of tamarind until we are in direct touch with the genuine dealer in that produce. It is therefore prescribed that tamarind shall also be leased out separately, the unit being the range.

665. Exploitation will normally be through the agency of contractors except from that portion of the Cumbum range which lies to the east of the Kumli ghat road. It is proposed to close the Surulipatti plateau to grazing with a view to minimise the danger from fire (vide paragraph 830 of Chapter XI. . .) and for the same reason it is desirable that all minor produce therefrom be collected under departmental control. We have formed a settlement of some twenty Paliyans at Vannathiparai in order to help the department with the various works attendant upon the propagation and collection of lac. It is necessary to provide these Paliyans with work congenial to them at the times when work on lac production is slack. With the increase in the number of Paliyans contemplated in Chapter XII of Part II this provision will become more imperative. It is well-known that Paliyans like to roam about the jungle and collect minor forest produce but it is desirable, both in the interest of our lac work and in their own interest, that contractors should have no hold whatever over the Paliyans. It is therefore prescribed that all minor forest produce (except avaram bark) in the reserves of the Cumbum range, to the east of the Kumli ghat road, be collected departmentally, for the next three years, through the agency of the Paliyans settled at Vannathiparai. The District Forest Officer may arrange to sell the collected produce in whatever manner he deems fit.

If, at the end of the period of three years, departmental collection be found unsatisfactory, it may be replaced by leases, with the sanction of the Conservator, except for the

area covered by the Surulipatti plateau. If the minor produce on this plateau is not to be collected departmentally, it will not be collected at all so that the forests may be free from this danger of fire.

Other occasions may arise when it may be desirable to exploit certain produce departmentally : this may be done with the previous sanction of the Conservator.

666. The following details are prescribed with reference to the leases of the various minor forest produce :—

(*a*) *Gallnuts.*—The right to collect gallnuts will be leased out separately for the following units :—

(1) The reserves and unreserves of Kodaikanal and Palni ranges.

(2) The unreserves of Cumbum range and such part of its reserves that lies to the west of the Kumli ghat road.

(3) The reserves and unreserves of Sholavandan, Aiyalur and Natham ranges.

The period of lease will be from 1st July to 30th June. A redistribution of units may only be made with the previous sanction of the Conservator.

(*b*) *Avaram bark* (Cassia auriculata) *and Ponnavaram leaves* (Cassia montana).—The lease will run from the 1st of April to the 31st of March. Reserves and unreserves will be sold together in each of the Sholavandan, Natham, Kodaikanal, Palni and Cumbum ranges and in that portion of Aiyalur range which lies in the revenue district of Madura. For the remaining portion of Aiyalur range which lies in the Trichinopoly district, the reserves and unreserves of Kulittalai taluk will be sold together as one unit : and the unreserves and road porambokes of each of the Trichinopoly, Karur and Lalgudi taluks will form three more units. Any redistribution of units that may be found desirable in future may be made with the approval of the Conservator.

(*c*) *Tamarind.*—Tamarind shall be leased out separately. The sale should be held in November when the trees are in fruit so that a reliable estimate of yeild may be formed. The lease shall run for six months, from the 1st of January to the end of June.

The following seven units will be sold separately :—

(1) The reserves and unreserves of the Sholavandan range,

(2) the reserves and unreserves of the Natham range,

(3) the reserves and unreserves of the Kodaikanal range,

(4) the reserves and unreserves of the Palni range,

(5) all the unreserves of the Cumbum range together with such portion of the reserves as fall to the west of the Kumli Ghat road,

(6) The reserves and unreserves of that part of the Ayyalur range which lies in Madura district, and

(7) the reserves and unreserves of that part of the Ayyalur range which lies in the Kulittalai taluk of the Trichinopoly district.

(*d*) *Other minor produce.*—All other items of minor produce shall be leased out jointly or separately at the discretion of the District Forest Officer, the units being the same as those detailed above for tamarind. Any particular item of produce may be sold separately, at the discretion of the District Forest Officer, if the demand for it is sufficiently good. The agreements with lessees should specify each of the items of produce leased out. The period of lease will normally be from the 1st of July to the 30th of June, but the District Forest Officer may reduce the period of lease over specified areas so as to exclude the fire season in order to minimise the risk of fire in such areas.

There is a vast number of *Buchanania latifolia* trees in the division in the " gallnut " type of forest. The kernel of the seed of this species is edible and commands good prices at Madras. It is suggested that attempts be made to find a sale for this produce, with the help of the Forest Utilization Officer.

SECTION 3.—PLANTING OF *Eriodendron anfractuosum.*

667. The activities of the Forest department, in so far as they relate to minor forest produce other than sandalwood, bamboos and lac, have been confined to the mere exploitation of what nature has chosen to place within our reach. If the economic possibilities

of some of the minor forest produce that can be produced in the forests be fully realized this attitude is bound to be replaced by schemes which are certain to add to the revenues of the State, without infringing on the rights of private enterprise. One such scheme is the cultivation of "Kapok"—the floss from the fruit of *Eriodendron anfractuosum*. The floss is ordinarily used for stuffing mattresses and pillows and is especially highly priced for the manufacture of life belts, and for temporary bridges in time of war.

668. *Silviculture.*—*Eriodendron anfractuosum* is grown in parts of the Madura district on the banks of streams or water channels and small plantations may be observed in the Palni, Kodaikanal and Cumbum ranges. The fruit ripens in March-April and the species is easy to raise from seed. It may be successfully planted out as small seedlings or better still as one year old stumps.

The tree is a strong light demander and grows rapidly, attaining some thirty feet in height at the end of three or four years when it often commences to bear fruit. The height growth culminates by about the tenth year at which age the tree yields, on an average, about 1,000 fruits every year. The yield is reported to increase thereafter till the tree is some 30 years old when the average annual production per tree rises to some 4,000 fruits, after which it falls off. The life of the tree is placed at fifty years.

The usual practice is to plant the trees about 20 feet apart, but under optimum conditions this spacing appears to be insufficient.

The fruits sell at Rs. 1–8–0 to Rs. 4 per 1,000. An acre of land can accommodate 75 trees at 24′ × 24′, and at the minimum rate of a rupee per tree per year (for a thousand fruits) a return of Rs. 75 per acre per annum may be expected. The cost of formation of one acre of the plantation has been estimated at Rs. 15.

669. In order to study the silviculture of the species at first hand, seeds were sown in nursery beds at Pandarathorai on 29th March 1934 and watered twice a week. Germination started on 13th May 1934 and was profuse by 22nd May 1934. On 13th June 1934 the seedlings were transplanted at an espacement of 6″ × 6″ on fresh beds. Severe defoliation by insects was observed in July but the leading shoots were left untouched. The beds were watered twice a week till the rains set in. The seedlings were about a foot high in August.

The seedlings from the original nursery beds (not the transplants) were planted out in the forest near Pandarathorai by the middle of October, in pits 1′ × 1′ × ½′, spaced 25 feet apart. Three seedlings were put out in each pit and 78 pits were planted up in all, over an area of about one acre. Shrubs and small poles standing over the plants were cut out to provide some overhead light but planting out over a clearfelled area after burning of the slash would have been the correct procedure. The plantation was last inspected in March 1935 when the plants were found to be thriving, but more overhead light appeared to be necessary.

The nursery transplants will be available for future planting.

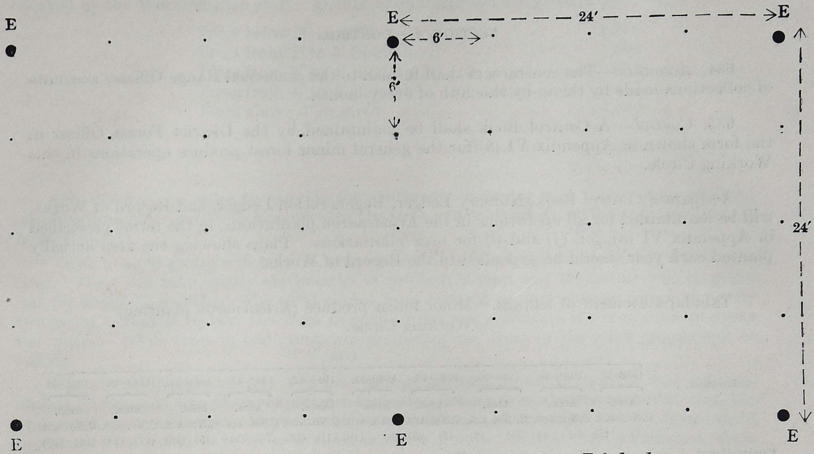
670. *Choice of site.*—An area of about twenty acres has been selected in the Pandarathorai reserve of Cumbum range for the formation of an experimental plantation. The locality is on the banks of the Suruli stream where the soil is deep well drained loam. A private plantation of the same species exists in the neighbourhood : it is about 40 years of age and is of good quality, thus indicating the suitability of the selected locality for the species.

671. *Annual planting area.*—An area of two acres will be planted up every year so that the total available area of twenty acres may be completely planted up in ten years.

672. *Soil preparation.*—An area of two acres will be clearfelled by the end of March. The slash left after the removal of the felled material will be heaped up and well burned by the end of April in the manner prescribed for the formation of teak plantations. Pits 1½′ × 1½′ × 1′ will then be prepared in May at an espacement of 24′ × 24′.

673. *Species and espacement.*—*Eriodendron anfractuosum* will be the primary species to be planted. The plants will be spaced 24′ × 24′. Since *Eriodendron* is a strong light demander with a light crown and since it is comparatively shortlived (about 50 years)

it is desirable to provide a suitable mixture in order to preserve the soil conditions. *Dalbergia latifolia* is most suited for the purpose and will therefore be planted out, 6′ × 6′, along with the *Eriodendron* in the manner sketched below :—



The small dots indicate *Dalbergia latifolia* and the large dots, *Eriodendron*.

674. *Nursery.*—Nurseries for providing the required number of stumps of *Eriodendron* and *Dalbergia latifolia* should be opened one year ahead of the year of planting. About 500 stumps of *Eriodendron* and 4,000 of *Dalbergia latifolia* may be provided for. The seedlings should be transplanted to other beds at an espacement of 6″ × 6″, when they are 3″ or 4″ high in the beds in which they are first raised.

675. *Planting out.*—In making stumps of *Eriodendron* as much of the tap root should be retained as may be necessary to avoid cutting through the carrotty portion. In other respects the recognized procedure may be adopted.

We cannot afford to have casualties among plants put out at what is intended to be their ultimate espacement ; hence two stumps will be planted in each of the pits prepared for the reception of *Eriodendron*, about six inches apart from each other. One stump of *Dalbergia latifolia* will be planted in a crowbar hole as indicated in the sketch in paragraph 673, above. The planting will be done in June, with the first showers of the south-west monsoon.

676. *Casualties.*—Casualties will be replaced in October with the outbreak of the north-east monsoon : provision has been made in paragraph 674 for the stumps that may be required for this purpose.

677. *Weeding.*—Two or three weedings may be required in the year of planting and one or two in the following year. Such weeding as may be found necessary will be done at the discretion of the District Forest Officer.

678. *Cleanings.*—The District Forest Officer must see that whatever cleaning is necessary is done so as to keep the plants free from the interference of coppice shoots of miscellaneous species and climbers. The aim should be to leave one healthy, established *Eriodendron* at the prescribed espacement. The beat subordinates can attend to this personally.

679. *Thinnings.*—No thinnings will be necessary among the *Eriodendron*. It is not expected that any thinnings will be found necessary among the *Dalbergia latifolia* within the period of the plan ; but if in the opinion of the District Forest Officer thinnings are necessary, they may be executed with the permission of the Conservator.

680. *Protection.*—Cattle must be kept out of the plantations.

681. *Demarcation.*—The plantations shall be demarcated by engraved stone slabs at all four corners, showing the year of formation.

682. *Exploitation of kapok.*—Some of the *Eriodendron* plants may be expected to yield fruits in the fifth year after planting. It is prescribed that, during the period of the plan, the kapok shall be farmed under strict departmental supervision so as to obtain a correct estimate of outturn per acre, for every age of the plantation. The capsules must be collected when fully ripe but *just before* they burst open as the elasticity of the floss suffers considerably if they are allowed to open by themselves.

683. *Cost of formation.*—No figures are available but, on the analogy of teak plantations, where the planting is 6′ × 6′, the cost of formation may be estimated at about Rs. 25 per acre, or rather more.

SECTION 4.—CONTROL.

684. *Accounts.*—The contractors shall furnish to the concerned Range Officers accounts of collections made by them, by the 20th of every month.

685. *Control.*—A Control Book shall be maintained by the District Forest Officer in the form shown in Appendix VI (*h*) for the general minor forest produce operations in this Working Circle.

A separate Control Book, Nursery Ledger, Regeneration Ledger, and Record of Works, will be maintained for all operations in the *Eriodendron* plantations, in the forms prescribed in Appendix VI (*a*), (*c*), (*j*) and (*l*) for teak plantations. Plans showing the area actually planted each year should be appended to the Record of Works.

Tabular statement of fellings. Minor forest produce (*Eriodendron* planting) Working Circle.

Location.	Years.																			
	1936–37.		1937–38.		1938–39.		1939–40.		1940–41.		1941–42.		1942–43.		1943–44.		1944–45.		1945–46.	
	Area.		Area.		Area.		Area.		Area.		Area.		Area.		Area.		Area.		Area.	
	C.No.	Acs.	C.No.	Acs.	C. No.	Acs.	C.No.	Acs.	C.No.	Acs.	C.No.	Acs.	C.No.	Acs.	C.No.	Acs.	C.No.	Acs.	C.No.	Acs.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Pandarathorai	..I ..	2	II.	2	III.	2	IV.	2	V	2	VI	2	VII.	2	VIII	2	IX.	2	X.	2

N.B.—Area felled in one year will be planted in the next year.

CHAPTER IX.—WORKING PLAN FOR THE LAC WORKING CIRCLE.

SECTION 1.—BASIS OF PROPOSALS.

686. The reserves in Madura district contain some of the well known lac hosts in sufficient numbers and in such localities as should prove suitable for the production of lac. *Schleichera trijuga*, *Shorea talura*, *Zizyphus jujuba*, *Zizyphus xylopyra* and other host trees which are not of much economic value at present, can be utilized to produce lac and thus made to yield regular returns. The question of introducing lac cultivation on such hosts occurring in suitable localities has therefore been under examination and experiment for some years now.

687. In Cumbum range there are nearly 7,500 Kusum (*Schleichera trijuga*) trees growing in gregarious patches mostly in Vannathiparai and Suranganar reserves. The trees are generally large and appear to be in good condition.

Kusum stands supreme amongst the lac hosts as it not only produces the best lac of commerce but also gives a higher yield than other hosts. It is known in Bihar and the Central Provinces as one of the best lac hosts and is used largely for lac cultivation. The Kusum brood is the best of all known broods as it will thrive on most of the important lac hosts, e.g., *Acacia catechu*, *Zizyphus jujuba* and *Butea frondosa*. Consequently it is greatly in demand and sometimes difficult to get. Demand for this brood lac will increase year after year as lac cultivation expands in the Madras Presidency.

688. The Vannathiparai Kusum area has been found climatically suitable for lac cultivation. Further, it is the only locality so far discovered in this Presidency which, due to the existence of a large number of good host trees and favourable climatic and other conditions, can be profitably formed into a lac farm for producing Kusum lac. The Kusum trees in the Vannathiparai reserve are therefore reserved for the production of lac, and constituted into the Kusum Lac Working Circle.

689. This Lac Working Scheme will be reviewed and revised after working it for five years from 1935 to 1940. The necessity for this revision is largely due to the fear that continuous cropping of old Kusum trees may impair their vitality to such an extent as to render them unfit for further use. If this be observed to be the case, they will have to be given rest for a longer period than what is prescribed herein.

SECTION 2.—ANALYSIS OF THE CROP AND DIVISION OF THE AREA.

690. The Kusum trees at Vannathiparai were enumerated by the District staff and checked by the Working Plan staff. Details of enumeration are given below :—

Trees below 2′ in girth	1,278
Trees from 2′ to 3′ in girth	532
Trees from 3′ to 4′ in girth	389
Trees from 4′ to 5′ in girth	437
Trees above 5′ in girth	4,660
Total ..	7,296

691. *Blocks.*—In order to provide for continuous cropping and to ensure a plentiful supply of brood lac at all infection periods, the trees will be divided into four groups (Blocks) A, B, C and D.

Trees in each group will be first pruned and then infected with lac about 18 months later. They will take nearly six months to produce a crop and thereafter will be given rest for about 18 months. The total period from pruning to crop cutting comes to nearly two years. That is to say, the trees in each group will produce a lac crop once in every two years. While trees in one group are producing lac, trees in the other groups will be resting.

The above division of trees into four groups is based on an 18 months' rest interval. Should, in the next five years, experience indicate a longer or a shorter period of rest, the groups will have to be accordingly increased or reduced. If two years' rest be found to be necessary trees would have to be divided into five groups ; if one year is sufficient, three groups will need to be used.

SECTION 3.—METHOD OF TREATMENT.

692. Successful lac cultivation depends primarily on the correct use of the lac insect, and secondarily on the correct use and treatment of the host trees, for the insect is closely related to the tree on which it lives and feeds. A thorough knowledge of the life history of the lac insect and the conditions under which it thrives are essential to all those who may have to give effect to the prescriptions of this plan. The publications of the Indian Lac Research Institute, Namkum, Ranchi, should be perused. The District Forest Officer should be in touch with the Director of the Institute in order to keep himself informed of the improvements and new methods evolved as a result of further investigation and research. He should not only equip his library with all the up-to-date publications of this Institute but also have his name included in the Institute's mailing list so that copies of publications may be sent to him as they are issued. A brief account of the life history of the lac insect and its enemies has been given in Appendix VIII.

An outline of the more important points in connection with the cultivation and marketing of lac is given in the following paragraphs.

693. *Treatment of host trees.*—Host trees found growing in crowded groups should be thinned out so as to admit more air and light. The yield of lac from crowded trees is much less than that from trees situated in the open with plenty of light and air around them.

694. *Pruning—Object.*—When the tiny lac larvae settle down close to one another on young twigs they grow to maturity producing a thick continuous encrustation of lac. If they happen to fix themselves to a shoot the bark on which is too thick and corky or too tender, most of them perish.

A tree has numerous shoots all of which are not of the same age nor of the same condition. When such a tree is infected for the first time the lac larvae will settle on most of the shoots but they will grow to maturity only on those few shoots, or portions of shoots, the bark on which is found suitable and a poor crop is the invariable result. But if one wishes to take the maximum crop that a host tree is capable of producing then something has got to be done to ensure that the largest number of suitable shoots are made available for infection on that tree. This object is achieved by pruning the host tree at the correct time and by infecting the shoots when they attain the most suitable condition.

The object of pruning before infection is to produce the largest number of young new shoots in order to get the maximum yield from a tree. So when lac cultivation is newly started in a locality every host tree is usually pruned before infection. Raiyats, however, do no preliminary pruning of Kusum in Bihar, and say that none beyond that involved in cutting the crop is necessary, even when lac has not been grown on the tree before. But

they do not aim at getting the maximum yield from the very start of cultivation as their main object is to start the cultivation with as little delay, and to do it with as little outlay, as possible.

Actually every host tree should be pruned in order to produce as many suitable shoots as possible which will function as efficient food suppliers to the numerous lac insects which settle on them and produce resin.

695. Almost all the trees detailed in paragraph 690 above can be used for cropping lac in order to obtain the maximum yield they are capable of producing. But, for want of sufficient and suitable labour, it is not possible to take all of them immediately for lac production. It is therefore proposed that young trees below 2′ in girth will not be utilized for producing lac but will be left to grow and develop their crowns. Of the remaining 6,018 trees, up to 500 trees will be taken up for cropping each season during the first cycle of two years (1936 and 1937) and thereafter up to 1,000 trees will produce the crop each season. It should be possible to recruit, train and organize sufficient labour for full lac operations by 1938.

696. In the second and subsequent cycles crop-cutting can be made to serve as pruning and pruning as a separate operation need not be done. But when infection fails or the crop dries up after early growth, the infected trees will have to be pruned in the following cropping season.

697. When pruning a tree preparatory to lac infection, due regard must be given to the tree itself and its future possibilities as a lac host. Every effort should be made, while obtaining the maximum number of suitable shoots capable of infection, not to damage the frame of the tree or to adversely affect its vitality, which must be preserved. Pruning should not reduce the size of the *frame* of the tree.

The indiscriminate lopping of big branches, under the guise of pruning, which reduces the size of the tree frame will not only affect the general health and vitality of the tree but will also make it unfit for continued cropping.

Too much stress cannot, therefore, be laid on the fact that pruning must be *light* and must be carefully carried out. Such a pruning should leave the *frame* of the tree little smaller than it was before pruning.

698. When crop cutting combined with pruning is done at a harvest, cutting should be done as much as possible on the new wood which has grown from the previous pruning, or pruning-cum-crop-cutting, leaving about 6 to 8 inches of new wood. This point is of great importance as such a method of crop cutting leaves the structure of the tree with an increased frame. Thus the trees will go on increasing in size crop after crop instead of diminishing or even drying up, as they do under haphazard and indiscriminate hacking.

699. *Method of pruning.*—The following instructions should serve as a guide in pruning, crop cutting or crop-cutting-cum-pruning :—

(1) The production of the maximum number of long new shoots suitable for infection should be the object, with the least possible damage to the tree.

(2) The aim should be to preserve as large a frame for the tree as possible.

(3) Pruning must be light and must be carefully done. The maximum diameter of branches to be cut is limited to $1\frac{1}{2}$ inches. The ends of all branches should be shortened back to wood of from $\frac{3}{4}$ inch to $1\frac{1}{2}$ inches, in diameter. The guiding principle is that shoots older than two years must be pruned because they are bound to be unfit for infection.

(4) Branches should generally be cut above the forks.

(5) All horizontal branches should be cut as near their ends as possible as they send out a large number of vertically growing shoots.

(6) The thinner the branch the nearer the main stem should it be cut.

(7) All dead and diseased branches must be removed.

(8) Crop-cutting-cum-pruning should be very lightly done. Cutting must be confined to the new wood which has grown up from the previous pruning, as far as possible, leaving about 6 to 8 inches of new wood.

(9) Trees should be *entirely* pruned. It is no good pruning half the tree and allowing the branches to remain intact on the other half or distributed all over the crown. In such cases the response to pruning is often poor.

(10) The cut branches should be allowed to lie on the ground and decay. Lac cultivation puts a heavy drain on the resources of the host tree. As artificial manuring of the host is not now contemplated, at least leaf manure obtained from its own crown should be allowed to remain on the ground.

700. The initial pruning must be done as far as possible in the presence of the Range Officer, who, before setting the new coolies to pruning work, will have a tree cut as a sample. To impress on those concerned the necessity for doing this work with the greatest care the writer would quote an officer with many years of experience in lac work in Bihar : " Success or failure of lac cultivation depends to a much greater extent on careful pruning of lac hosts than people generally believe."

The response to judicious pruning done on the above lines has invariably been satisfactory. Kusum trees pruned for the first time throw out exceedingly healthy shoots and appear to be ready for infection one year from the date of pruning them.

701. *Cost of pruning.*—The cost of pruning will vary with the size and shape of the crown. It will depend also on the sort of labour available.

Most of the Kusum trees are tall, with big spreading crowns. The local village coolies are afraid to climb up to the tops of these trees to prune the branches. Paliyans (Hill men) are expert climbers of trees but are not accustomed to lop branches all day long and for days together at a stretch. Further, they are few in number. So, suitable coolies from the adjoining villages will have to be selected and gradually trained for pruning and crop cutting work.

Pruning season.

702. The best time for pruning Kusum trees is just before their leaves turn yellow and are shed, which usually happens in February. When a large number of trees have to be pruned for the first time, pruning should be commenced early in January. This prescription for initial pruning is in accordance with the practice obtaining in North India, but in the second and subsequent cycles it cannot be always adhered to.

703. In the short period of three years during which six regular crops were grown at Vannathiparai, crop cutting had had to be done in the months of January, May, June, July, November and December. This was inevitable because the crops did not take full six months to mature but only 5 months 10 days to 5 months 26 days. In 1932, the rains (Aghani) crop was cut on the 20th January, and in 1934 it was cut on the 17th November, nearly 2 months in advance. The crop-cutting time has been moving backward from crop to crop. Should this continue, crops will have to be cut in almost all the months of a year, and not only in January and July as is the practice in North India, and our exceptional experience should prove unique.

At every harvest during the months mentioned above, crop-cutting-cum-pruning was done and the response to shoot production has been satisfactory so far.

704. It is stated in the publications of the Indian Lac Research Institute that the pruning times for Kusum are February and July and that it should not be pruned in November. But our last crop matured on the 17th of November, and we had no alternative but to do the crop cutting and pruning in November. Trees similarly dealt with in the beginning of December last year successfully responded to such a treatment, so that there appears to be no cause for pessimism on this point.

Crop-cutting-cum-pruning will, therefore, continue to be done at such seasons of the year as the crop matures.

705. The climatic conditions prevailing in the Cumbum valley are largely responsible for the lac crop not taking exactly six months to mature as in North India. Our South Indian *Shorea talura* brood which gives three crops in 13 months, produced only two broods per year at the Lac Research Institute.

706. *Brood Lac.*—Lac to be used as brood should be cut as close to the swarming date as possible, never earlier than a week before swarming is due. When cultivation is done on a restricted scale and crop cutting and infection are done in the same locality and labour is not scarce, it is a good plan to wait until the brood actually begins to swarm and then to cut it quickly and infect the trees.

Brood lac should be carefully examined. All unhealthy and pest infected sticks should be rejected. Only healthy uninfected brood sticks must be selected and used for infection purposes. Sticks on which the cells are closely situated, or are coalesced without much overlapping, are the most valuable for brood purposes.

Infection as Inoculation.

707. There are two methods of infecting trees :—

1. Natural or self-infection, and
2. Artificial infection.

(1) *Natural infection.*

708. The cultivator leaves on the lac bearing trees sufficient mature crop to swarm *in situ* and to colonise all the suitable shoots. This method is referred to as natural infection.

It is not recommended in spite of its simplicity and cheapness, as uniform inoculation of all infectible shoots cannot be ensured nor can the production of regular crops. The main objection to it is, however, based on the fact that it favours the multiplication of enemies of the lac insect.

(2) *Artificial infection.*

709. In artificial infection the mature crop is cut *just before* swarming and put on to the new trees. There are several methods of artificial infection. The ideal one is that which resembles natural conditions most, namely, to tie a stick of brood lac to each shoot or to wedge and tie it between two twigs. The emerging larvae can then walk directly from either end of the brood stick on to their new home. This method, besides being slow and costly, results often in over-infection of the shoots, necessitating early transfer of brood lac to other uninfected shoots or twigs.

710. The commonest method is to tie several sticks of brood lac loosely with string to a branch of the tree immediately below the point from which a group of infectible shoots arise. The actual tying of the brood to the tree can frequently be dispensed with by placing the brood sticks or bundles in among the bases of a number of twigs or at the nearest forks.

711. Small pieces of broken lac or sticks too small to be tied can be put in cups or small baskets of wire gauze or bamboo and used for infection purposes. These can be rested on and tied to branches or hung from them.

712. Brood sticks or bundles should be tied to the branches so that they lie along the branches touching them over their full length. When tying them, care should be taken to see that their ends touch the branches. Sometimes the brood sticks are tied across the gaps between two shoots or branches so that one end of the stick touches each branch. This lateral method of tying, besides being laborious, is rather unsafe in times of wind and rain, as the sticks tend to slip down. Experience indicates the longitudinal method to be simpler than the lateral one from the point of view of securing the brood to the tree ; both are however equally efficient for infection purposes.

713. All these methods of artificial infection, viz., by single sticks and by bundles, by the longitudinal, the lateral and the interlaced methods may be used as found advisable.

714. Successful inoculation should ensure that all the available infectible shoots are sufficiently colonised by the larvae with the minimum quantity of brood lac. To tie too much brood lac to a tree is to over-inoculate it and thereby kill the shoots and lose the brood. With a large number of insects the twigs are unable to respond to the drain on them and they wither and die. When inoculating trees great care should therefore be taken that they are not over-inoculated. Over-infection can be avoided if points of infection in each branch and tree are selected with care. A number of vigorous shoots radiating from a point should be selected for infection whilst scattered, thin, wiry shoots may be left uninfected. Not more than half the lengths of shoots are to be allowed to be covered by the lac larvae, and the brood lac should be removed from the infected trees when this stage is reached.

715. The amount of brood lac to be tied at each place, or required to inoculate a tree, must depend on the circumstances of each case and can only be learnt by practical experience. To know the correct amount of brood to be used is important as any shoots left uninfected due to want of sufficient brood are so much waste, and excess of brood is not only a waste of brood lac but also causes over-infection with the result that both the shoots and the crop on them are lost.

The quantity of brood lac put on each Kusum tree is given in the history of crops (Appendix VIII). The average quantity put on a tree varied from 25 to 40 lb., which may be taken as good working averages. The exact quantity will however depend on the size of the crown and the number of infection points.

716. *Settlement.*—The larvae prefer to settle down particularly on the underside of succulent twigs. On vertical shoots they settle down all round the stem. Once settled, the larvae never move again. They colonise in very large numbers, often completely covering the lower surface of the twigs, each larva touching or at least being very close to its neighbour.

717. *Removal of the stick lac.*—During the inoculation period the infected trees should be examined periodically to prevent over-inoculation. As soon as all the infected shoots are seen to be covered to half their lengths with a fairly close carpet of larvae, the brood sticks should be removed.

The larvae continue to come out for four weeks, but generally swarm in large numbers during the first fortnight if the weather continues to be bright and normal. The brood lac should be allowed to remain on the trees during the period when swarming is brisk, i.e., 10 to 15 days, and should then be removed even though some larvae still continue to emerge. The reason for doing this is that the great majority of the lac larvae would have emerged in this period, while quite a number of its enemies would not have emerged.

It is very important to make sure that all the brood lac put on each tree is removed and that nothing is missed out to remain on the tree or to lie on the ground lest the predators and parasites of lac should continue to emerge from the brood stocks.

718. *Transfer of brood lac.*—Experience gained in the transfer of brood lac should serve as a guide. Trees infected by transfer rarely produced any crop. So the practice of transferring brood lac from tree to tree was discontinued. It should be discouraged and abandoned altogether.

Transfer of brood lac, after leaving it for 10 or 12 days on the infected trees, to other new trees for infection purposes, is distinctly harmful as more insect enemies of lac emerge during this period than lac larvae.

The necessity for transfer of brood lac can be avoided by tying just the required quantity of brood lac at the first instance and removing it once for all after 10 to 14 days. This will also go to reduce the cost of infection.

719. *Crop cutting.*—Signs of crop maturity and impending swarming should be carefully watched for and the crop to be used as brood should be cut just sufficiently long before swarming to allow time for cutting and tying brood lac on to fresh trees before the swarming starts. Lac not intended for brood may be cut two to three weeks in advance according to the labour available. It is better not to let swarming occur on this lac. Its earlier removal will also minimise the emergence of lac enemies at the time of cutting the brood lac.

Brood lac which is to be sent to other places in this Presidency should be cut just long enough before swarming to allow it time to reach its destination and be tied to the trees before swarming occurs. To get satisfactory results about ten days is the earliest that it should be cut.

As crop cutting is to serve as a pruning, indiscriminate lopping of the branches should never be indulged in. Crop cutting must be done with the greatest care on the lines prescribed for pruning of trees in paragraph 699. Cutting must be on the new wood grown since the previous pruning, leaving six to eight inches of new wood.

SECTION 4.—CONVERSION AND DISPOSAL OF LAC.

720. *Scraping of lac.*—Brood lac not required for inoculation and phunki lac removed from infected trees should not be stored, as it breeds out the insect enemies of lac and also because the lac encrustation on it is damaged during storage by the larvæ of *Eublemma* and *Holcocera* (Appendix VIII). Stick lac which cannot be disposed of immediately should be scraped and washed or fumigated with *Carbon bisulphide* if it has to be kept for sometime. The encrustation will come off if beaten with wooden mallets or scraped with knives. The yield of scraped lac from a maund of stick lac is approximately 55 to 60 pounds.

721. The scraped lac should never be exposed to the sun or heat as it will melt and become blocky. It can be thoroughly dried in the shade and for this purpose it is spread out in thin layers and repeatedly turned over until quite dry. The common method of storage is to keep it in layers about 4″ to 5″ deep, in a dry, airy and cool place where it should be daily raked over. Moveable trays arranged on racks can be used for this purpose. It should not be stored in gunny bags.

Should it ‘ block ’, it should be immediately broken to pieces with hammers. It must not be allowed to remain long in blocks as it degrades rapidly and becomes discoloured as well.

722. *Crushing of lac.*—From the lac encrustation two substances of commercial importance are obtained :—

(1) Pure resin commercially known as *seed lac* and (2) Lac dye.

723. To prepare them, the encrustation has to be crushed and washed. In crushing care should be taken to see that the encrustation is neither ground too fine nor too big.

The granules are to be of such a size that the colouring matter from all the lac cells can be readily and fully washed out leaving the resin in granules. The process largely in use is detailed below :—

724. The scraped lac is winnowed to remove bits of wood, bark, leaves, stones, etc. It is then passed through a sieve of 4–5 meshes to an inch. What comes through the sieve should be kept for washing and what is held up should be ground in stone grinders or corn or coffee crushers to a uniform size so as to pass through that sieve.

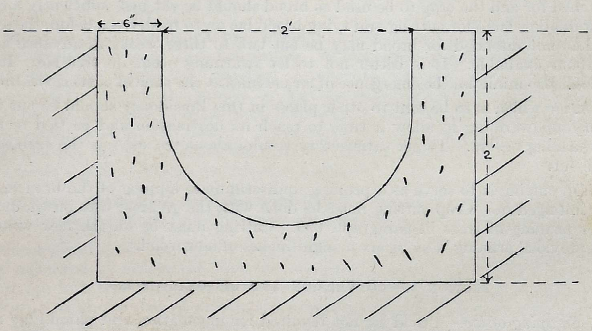
725. The big lac factories in Bihar purchase stick lac, *ari* or *phunki*. The encrustation is not scraped but the encrusted portions of sticks are cut into bits of two inches and less. These are crushed in two ways :—

(1) By hand crushing in an ordinary mortar-grinding mill consisting of a flat stone on which a stone roller slides up and down or in a corn grinding mill consisting of two flat circular stones arranged one above the other, the upper one of which is turned round and round by means of a wooden handle.

(2) By mechanical crushing in machines like coffee crushers, worked by hand or power.

The crushed material is first passed over a rectangular sieve with half-inch meshes, kept in a slanting position. Most of the crushed lac passes through the meshes but the sticks roll down. These sticks are examined by women who pick out all those that still contain some lac. The lac is next passed through a sieve of 4–5 meshes-to-an-inch and dealt with as described above.

726. In some places the fine dust that comes through a sieve of 32 meshes to an inch is taken and stored separately and disposed of as such for dyeing purposes. It is sold as "Lac dust."



727. *Washing and drying.*—Washing is done in vats of stone, wood or masonry and in earthen pots. They are fixed in a row on a pucca cemented floor. The size largely in use is the one in which a maund of ground lac can be washed at a time. Such a stone vat is $2\frac{1}{2}'$ to $3'$ in diameter, and up to $2'$ in height. Where a large quantity of lac has to be regularly washed stone vats are recommended. Granite blocks of the size and shape shown in the diagram above can be buried, almost to the ground level, in a row and the space around and between them cemented to form a pucca floor with drains to lead off the coloured water.

728. Water in large quantities is required for washing. About 100 gallons of water will be required for washing a maund of crushed lac. The cost of supplying this water can be reduced to a minimum if washing is done close to a well or stream ; it ought not to exceed an anna per maund of ground lac.

729. It has been observed that when 'hard' water was used washing could be conducted in a shorter time. The metallic salts in 'hard' water apparently accelerate the loosening and removal of the dye.

730. Ground lac is put into vats in the evening and allowed to soak in water during the whole night. Next morning it is rubbed with both hands or with the feet. When it is not possible to let the lac soak for at least 12 hours, a small quantity of water is poured on it and the whole mass turned over for about 10 minutes till it gets moist and is well mixed. After an interval of 15 minutes more water is added and the stuff rubbed and turned with the feet. Bits of wood, bark, dust, etc., floating on the top are removed by a sieve and put

into a basket kept for that purpose. After working for 15–20 minutes the man gets out of the vat and skims off the suspended materials, dust and minute particles of resin, with a porous cloth. The resultant material is light and dull coloured and is called *Molemma*; it is rinsed and pressed into the form of a circular cake and put into a bamboo basket.

731. If lac dye is to be prepared, the coloured water from the first 2–3 washes is run into a pit built for the purpose. More water is poured into the vat and the rubbing continued until the last trace of the dye has disappeared and the water remains quite clear. This stage will be reached after five or six changes of water. The washed material is then taken out of the vat and put into a bamboo basket placed on a plank on the top of the vat. Two or three tins of water are poured into this basket to remove the last trace of colour, if any.

732. The washed lac has an orange-yellow colour and is technically known as *seed lac.* After the water has completely drained away the basket is taken to the drying floor and its contents spread out in a thin layer on the pucca floor. It is dried in the sun for about half an hour and then in the shade. If left longer in the hot sun the wax will melt.

When thoroughly dry it is carefully sifted and cleaned by women for the last time in 'morams' (bamboo trays) and bits of wood, bark, stones, sand, etc., removed. Red or dark coloured grains are picked out, ground and washed again. Bigger grains held up by a sieve of five to six meshes to an inch will have to be recrushed and washed as they will contain some dye.

733. Drying and cleaning is always done by women. Each woman on an average can clean $1\frac{1}{2}$ to 2 maunds a day. A man can grind and wash up to $1\frac{1}{2}$ maunds in a day.

734. In some factories a little "washing soda" is lightly sprinkled over the washed lac at the rate of 2 ounces to a maund (82 lb.) and the whole quantity is turned over and over so that the soda is thoroughly mixed up with the lac. After 15 minutes, it is rubbed briskly and washed in water twice. Soda is added to remove the last traces of the dye quickly and completely, and thereby improve the colour of the washed lac. If more soda than what is prescribed above is added or if the soda is left in the vat for a longer time, it acts detrimentally on the resin. So care should be taken not to add an excess of soda. Fuller's earth is sometimes used in place of soda in Bihar.

735. The yield of washed lac from stick lac in the past has been in the proportion of 1 : 2·8. Under improved conditions of crushing and washing the yield is expected to increase.

736. Washed lac should be stored loose, turned over at intervals and kept in a cool, airy place.

737. The washing process described above being slow and somewhat wasteful, mechanical washing machines worked by power have recently been installed in some big factories. A small mechanical washing machine was also set up in the Indian Lac Research Institute and the following extract from the Institute's report may prove useful :—

> "A study has been made of the two methods of washing seed lac : (*a*) the usual manual method and (*b*) the mechanical method using a rotating agitator washing machine. The results of these experiments would appear to indicate that the manual process offers certain advantages. While the mechanical process gives a higher yield on washing, this is counter balanced by lower yields on manufacture into shellac. This is explained by the higher percentage of impurities in mechanically washed seed lac which reduces the yield on manufacture into shellac. The colour of machine washed seed lacs is in general darker than if washed manually. The high quality now demanded in seed lacs may lend importance to the manual method. A combination of the two methods has been found satisfactory. The lac is fairly well washed in the machine and is then transferred to the basins and washing completed manually."

The consensus of opinion amongst manufacturers, however, indicates a preference for the manual method. This in a way is to the good from the point of view of employment, especially as there is a falling demand for shellac and a growing preference for washed lac.

738. *Lac dye.*—In the last century seed lac was considered a waste and lac was sought after for its dye which was extensively used for colouring wool, silk, and leather. Since the introduction of aniline dyes it is being used in this Presidency solely for dyeing 'eri' silk thread and cloth.

739. For the preparation of the Lac dye the method in vogue in North Salem, which is described below, may be adopted :—

The thick dye liquor obtained from the first 3 washings is first run through a close-mesh sieve and then poured on a thick gunny or cloth kept spread over a depression

made on a heap of sand. A pinch of *Calcium chloride* is added to every bucketful of filtered liquor to precipitate the dye. Water is slowly absorbed by the sand and the dye remains on the gunny or cloth as sediment. It is then scraped and dried in shade. The dye should be spread in very thin layers for quick drying. Otherwise it gets spoiled by a fungus. Drying in the sun also spoils the quality of the dye.

740. In Bangalore, water from the first 2 or 3 washings is simply allowed to stand for 12 hours or more to deposit the dye. Clear water at the top is run off and the thick dye liquor at the bottom is allowed to dry up by simple evaporation. No quicklime, lime-water or oxide of tin is added for precipitating the dye.

741. Ground lac which passes through a sieve of 32 meshes-to-an-inch is also used for dyeing. One pound of this fine dust is put in a gallon of water in the evening and allowed to soak till the following morning when about half to one ounce of clean tamarind is added. The mixture is set to boil slowly for an hour, adding more water if the evaporation is rapid. It is then filtered and the filtrate is allowed to boil again when the alum-mordanted silk to be dyed is put into it. To make the colour deep, a few pinches of *soda bicarbonate* is added to the solution while the lac dust is boiling.

742. Hard water should be preferred for washing ground lac if dye has to be prepared from it. It should also be used when ground lac is used for dyeing purposes. Hard water precipitates the dye, while soft water gives a perfect and permanent solution.

743. *Deterioration of lac on storage.*—The following extracts are from the reports of the Indian Lac Research Institute :—

"The problem of preventing the falling off in quality due to storage is a very important one. At least 70 per cent of the shellac manufactured could be fine and superfine if the stick lac was not more than a year old when it got to the factory.

"Unfortunately, however, so long as the price of shellac is fluctuating the practice of storing stick lac for long periods awaiting better prices will be resorted to, and the ideal conditions whereby stick lac is cut, washed, manufactured into shellac and exported to a cooler climate with as little delay as possible, will not be realized. It is a point worthy of great emphasis that stick lac, washed lac and shellac, while stored in a hot climate, are very rapidly polymerising and deteriorating in quality and in 3 or 4 years are almost ruined for many industrial purposes.

"The rate of polymerisation is accelerated by increasing temperature. In a cool climate it is relatively slow and in cold storage it is pratically zero. It is obvious that if the initial high fluidity of lac is to be retained, the time the material is kept in India, either as stick lac or shellac, should be reduced to a minimum, and such storage as is necessary must be done in as cool a place as possible. It may be pointed out that this property of high fluidity is of the utmost importance to the moulding and gramophone industries which take over 50 per cent of the exported shellac."

744. *Grading of lac.*—Washed lac is graded into granular seed lac and dust. That which passes through a sieve of 24–28 meshes-to-an-inch is termed dust. Grains are divided into 'large' and 'small' by a sieve of 10 meshes-to-an-inch.

745. *Disposal of lac.*—All sales of lac shall be effected in consultation with the Forest Utilization Officer, who will issue necessary instructions from time to time, in regard to the quantities of stick lac to be converted into the various grades of washed lac, and the parties to whom they may be consigned.

SECTION 5.—TABULAR STATEMENT OF LAC OPERATIONS.

746. The initial pruning of Kusum trees will be done in January-February and in June-July. Up to 500 trees in each group will be pruned during each period. The times of crop cutting and infection forecasted in the statement below are only approximate as they depend on the actual period taken by a crop to mature which has been found to vary slightly.

The initial pruning of trees will be suspended during 1936 as Paliyan labour is at present insufficient : this will save time and money without much diminution in crop production.

Statement of Lac operations.

Group.	Total number of trees.		Pruning time.	Infection time.	Crop cutting.
A	1,000	500	January-February 1935	May 1936	October-November 1936.
				April 1938	October 1938.
		500	January-February 1937	April 1938	
B	1,000	500	June-July 1935	October-November 1936	April-May 1937.
				October 1938	April 1939.
		500	June-July 1937	October 1938	
C	1,000	500	....	April-May 1937	October 1937.
				April 1939	October 1939.
		500	January—February 1938	April 1939	
D	1,000	500	....	October 1937	April 1937.
				October 1939	March-April 1940.
		500	June-July 1938	October 1939	

747. The above operations are arranged below in the order in which they will occur :—

Year.	Months.	Operations.	Number of trees.	Groups.
1935	January-February	Prune	500	A
	June-July	Prune	500	B
1936	May	Infect	500	A
	October-November	Cut-crop	500	A
	October-November	Infect	500	B
1937	January-February	Prune	500	A
	April-May	Cut-crop	500	B
	Do.	Infect	500	C
	June-July	Prune	500	B
	October	Cut-crop	500	C
	October	Infect	500	D
1938	January-February	Prune	500	C
	April	Cut-crop	500	D
	April	Infect	1,000	A
	June-July	Prune	500	D
	October	Cut-crop	1,000	A
	October	Infect	1,000	B
1939	April	Cut-crop	1,000	B
	April	Infect	1,000	C
	October	Cut-crop	1,000	C
	October	Infect	1,000	D
1940	March-April	Cut-crop	1,000	D
	March-April	Infect	1,000	A

SECTION 6.—SUBSIDIARY SYLVICULTURAL REGULATIONS.

748. *Cleaning.*—Trees of other species which are too close to the host trees and are interfering with their growth or with the sunlight that reaches them, should be removed. When, through hollowness, disease, rot or any other cause, the host tree shows a lack of vitality and is unfit for cropping lac, the tree should be coppiced early in February.

749. *Experimental Pollarding.*—Twenty Kusum saplings of 6 to 12 inches girth have been selected near the Vannathiparai resthouse and topped at heights of 4 and 5 feet early in February 1935. Ten saplings have been selected and topped at 4 feet from ground level and ten at five feet. The resultant shoots which will take off just below the cut should be topped again in February 1937 when they are two years old. The secondary shoots resulting from this pruning should be cut again in February 1939. Cutting must be done on new wood which has grown from the previous pruning, leaving from one to two feet of the new stout shoots.

This kind of pollarding and pruning will, it is hoped, result in what may be called ' candelabra branching ' and render all portions of the resulting crown easily accessible to coolies for pruning and cropping purposes.

The subjoined statement shows the number on the saplings operated on, the girth and the height at which the cut has been made :—

List of Schleichera saplings pollarded in Vannathiparai Lac Farm.

Serial number on saplings.	Girth at breast height. FT.	IN.	Height at which Pollarded.
4	0	6½	Pollarded at a height of 4 feet from ground level.
7	0	6	
9	0	7½	
11	0	8	
22	0	9	
26	0	8½	
28	0	7	
30	0	8	

Serial number on saplings.	Girth at breast height. FT. IN.	Height at which Pollarded.
32	0 9	Pollarded at a height of 4 feet from ground level.
19	0 11½	
5	0 8	Pollarded at a height of 5 feet from ground level.
8	1 1½	
10	0 9	
12	0 5	
23	1 ½	
25	0 9	
27	0 6	
29	0 6½	
31	0 9	
14	0 7	

750. *Regeneration by root suckers.* (*Experimental*).—Reproduction of Kusum by root suckers should be induced. Roots which are within a foot of the ground level should be exposed and the bark cut through in a few places. These exposed spots should be permanently staked.

Ten trees should be so treated each year and results watched.

Planting in blanks.

751. An acre will be planted up every year with seedlings cf Kusum. The plantation will be formed from nursery grown transplants on the lines indicated below :—

752. *Clearing of site.*—The plantation sites require to be cleared of existing vegetation. All trees, and shrubs except Kusum and rosewood, should be cut in November-December preceding the year in which the area will be planted. Such of the cut material as is unsaleable should ordinarily be burnt in March-April.

753. *Pits.*—Pits will be dug at a triangular espacement of 15′ × 15′ to 20′ × 20′. Each pit will be 2½ feet in depth and 2 feet in diameter. The diameter of the pit is of less importance than the depth. Filling of pits can be done two or three weeks before the transplanting season In the plantations in the Indian Lac Research Institute, " pits are manured at the rate of one pound of concentrated superphosphate, ½ oz. of Ammonium sulphate and ½ oz. of Potassium sulphate per pit."

754. *Collection of seed.*—It is laid down that Kusum seeds should be collected in June in the year preceding that in which they are to be sown. According to the Forest Research Officer, Bihar and Orissa, " Kusum seeds must be stored for an entire year for good germination : fresh seed does not seem to germinate ". But our local experience is different. Fresh seeds collected at Vannathiparai in July were dried in the shade for a fortnight and sown in broken up soil on the 4th August. They were not watered and there was no rain that month. After a few showers in the beginning of September, the seeds started germinating in about 10 days and the seedlings were 6 inches high by the end of that month. Similar results were obtained in North Salem where fresh seeds sown in nursery beds at the end of May and watered daily germinated in about 10 days.

Fresh and one year old seeds should be sown separately and results recorded.

755. *Sowing of seeds in nursery beds.*—In the Government plantations in Bihar, Kusum seeds are sown in the first week of April on watered nursery beds in drills, in lines 6 inches apart and one inch apart in the lines. In the Lac Research Institute's nursery the seeds are generally sown in March. Roughly, each bed (20 feet long 2 feet wide and 1 foot deep) accommodates about 100 seeds planted in three rows. The beds are watered daily till the seeds germinate : subsequently, twice or thrice a week.

Seedlings intended for stump planting must be transplanted into pricking out beds, spaced 9″ × 9″, at the break of the rains.

756. *Transplanting.*—The following methods which are practised in Bihar may be adopted :—

(i) In the Lac Research Institute, transplanting is done just before the monsoon when the seedlings resulting from March sowings will have attained a height of 8 to 9 inches. Plants from the beds are transplanted into pits without any pruning of the root or shoot. Failures are replaced from the beds.

(ii) In the Lac plantations formed by the Bihar Forest Department, seedlings 14 months old grown in pricking out beds are used for transplanting. At the break of the rains the plants are transplanted into pits in the form of root and shoot cuttings (stumps). All the side roots are removed and the tap root left is not more than 9 to 12 inches long. The shoot portion is 2 to 3 inches in length. More plants should not be pruned at a time than can be put out in the day.

(iii) Seeds are sown in April in pots usually 4 inches across and 10 inches long. When the seedlings are about 6 inches high the pots are taken to the pits and the seedlings removed with balls of earth round their roots and planted in holes already prepared.

757. *Watering.*—The Lac Research Institute consider it essential to water the transplants twice a week during the next winter and summer ; but the Bihar Forest Department have not prescribed any watering in their plantations. The plants should be watered as found necessary, should dry weather prevail for several days following transplanting.

758. *Weeding.*—During the first three years probably three weedings a year may be necessary. Weedings should take the form of uprooting all weeds growing within a radius of 3 feet from the plant.

During the weedings and periodically afterwards the soil should be hoed up in the area cleared of weeds. Soil cultivation by ploughing is a very important factor in attaining success. In fact the key to success is intensive soil cultivation. The whole of the planting area should be thoroughly and deeply ploughed every year, and not only a few square feet round the plants.

758-A. *Experimental "Rab" regeneration.*—An area of one acre will be regenerated every year with *Schleichera trijuga* in the Vannathiparai valley, for a period of three years as an experimental measure, under the method of "rab" sowings. The plots will be taken up within the 50·5 acres of unsuccessful teak plantations prescribed for regeneration with teak under the kumri series of the Clear-felling Working Circle (Vide paragraphs 461 and 480) but outside the coupes prescribed for teak planting during the three years. The method of regeneration has been fully described in paragraphs 560 to 573 under the Working Plan for the Fuel Working Circle. The seeds may be collected as directed in paragraphs 754 above. The results will be reviewed at the end of the three years (1937, 1938 and 1939). The Conservator of Forests will then compare the relative advantages of growing teak and *Schleichera trijuga* in this locality and obtain the orders of the Chief Conservator on the species to be ultimately grown therein.

SECTION 7.—OTHER REGULATIONS : CONTROL.

759. Trees will be numbered serially as they are pruned. Each tree will be known by a number painted on it. This number will also be nailed on to it on a zinc plate. These numbers and plates will be checked and renewed during every infection of the tree. Four different colours may be used for the four groups.

760. *Record of weather conditions.*—Climate plays an important part in the development of the lac insect and the yield of lac. There appears little doubt that a correlation of meteorological observations for the Vannathiparai area, with the crop returns, will enable one to note the effect of any unusual climatic condition on the lac crops. The most important of the climatic factors affecting lac are rainfall, temperature and humidity. An accurate record of these weather conditions during the year must be maintained.

761. *History of trees.*—The history of each tree should be maintained in a bound register in the form given in Appendix VIII. This important record will show whether the present system of continuous cropping with rest for intervals of 18 months adversely affects the health and vitality of the old trees. Sufficient space to make five consecutive crop entries, as shown in the sample entry given in Appendix VIII, should be left for each entry.

762. *Record of Lac operations.*—The maintenance of proper records of lac cultivation is a matter of extreme importance. All important matters connected with the production of lac and its conversion and disposal should be accurately recorded, crop after crop, in a bound register. Such records if accurately kept over a number of years will prove extremely valuable. They will not only show the profit or loss from lac cultivation but will also give an idea of the amount of brood that must be used, the yield that can be expected

which crops are successful and which poor, failures, etc. Information relevant to each crop will be briefly summarised in the form given in Appendix VIII in the manner indicated therein.

763. *Buildings.*—A shed for storing lac has been built at Vannathiparai in 1935–36 at a cost of Rs. 1,550. A washing and drying floor was also constructed at Cumbum for Rs. 254 in the same year.

The following buildings are urgently required :—

Proposed year of construction.	Particulars.	Estimated cost.
		RS.
1936–37 ..	Quarters for 30 paliyans at Vannathiparai. Two lines, each 100 feet × 16 feet, with corrugated iron roof.	1,500
	Plant and equipment for crushing and washing, etc.	500
1937–38 ..	Quarters for 30 Paliyans at Vannathiparai	1,500
	Extension to the lac godown at Cumbum	1,000
	Work shed, 100 feet × 15 feet	1,000
	Total ..	5,500
	Add cost of buildings already constructed	1,804
	Grand total ..	7,304

764. *Establishment.*—Lac cultivation began on a small experimental scale in Cumbum range. Its gradual expansion, year after year, has not only made it more and more important and remunerative but has also shown the necessity for a permanent staff specially trained for lac work. In the short period that lac operations have been in progress, there were three changes in Rangers and several in the Foresters and Forest Guards. That frequent changes in the subordinates engaged on lac operations are not conducive to their development will be readily conceded. And the need for a specially trained staff to expand and stabilize this industry on a permanent basis will also be apparent. It is therefore suggested that neither the Range Officer nor the Assistant Ranger, (proposed below), should in ordinary circumstances be transferred out of the Cumbum range unless the Ranger left behind has had experience of at least two crops.

Special staff required for lac operations and its cost are :—

Staff.	Cost per annum.
	RS.
An Assistant Ranger on Rs. 80 a month	960
Motor cycle allowance	180
A Forester on Rs. 40	500
Three watchers (Paliyans recommended, on Rs. 10 a month each) ..	360
Miscellaneous, travelling allowances, etc.	500
Total ..	2,500

765. *Labour.*—Scarcity of suitable labour has been a great handicap since the inception of lac experiments at Vannathiparai. For the same reason, expansion of lac cultivation to the maximum could not be prescribed in the present scheme. Without adequate labour many trees will have to be idling for years awaiting their turn to produce a crop. This is most uneconomic, more particularly at the present time, when there is good demand and prices are improving.

As Paliyans are the only people who can do the pruning, infection, etc., on the big Kusum trees, they should be recruited in their villages, brought and settled at Vannathiparai. Houses should be built for them and land for cultivation should be given free of assessment, to serve as inducements to them to settle permanently in our forests. Employment of two or three suitable men as Watchers will also be advisable and should help to keep the settlers contented.

There are now 10 families in the settlement. Their number should be doubled and if possible, trebled, in 1935, and increased to fifty by 1938 if the operations are to expand on the prescribed lines.

When work on lac operation is slack the Paliyans may be usefully employed in collecting minor forest produce for the department, provision for which has been made under the Working Plan for the Minor Forest Produce Working Circle.

766. *Cultivation of Lac on Shorea talura* : *Experimental.*—*Shorea talura* occurs in large numbers in gregarious patches on the Karandamali plateau, on the Alagar hills and in other places. It affects the upper slopes and hill tops at elevations varying from two to three thousand feet. The climatic conditions obtaining in these localities appear to be similar to those prevailing on the Hosur plateau in North Salem, where lac is being grown on *Shorea talura*. It is proposed to try the introduction of lac on *Shorea* on the Karandamalais on an experimental scale.

The *Shorea* on the Karandamalais was stockmapped by the Working Plans Staff and enumerations of sample plots were conducted, on the results of which it is estimated that there are about 49,000 *Shorea* trees on the Karandamalai plateau, above a breast height girth of two feet.

One thousand trees of *Shorea talura* above a breast height girth of two feet will be selected in a compact area near the villages on the Karandamalai plateau. They will be pruned in July-August 1936, in the manner prescribed for Kusum trees. Unhealthy or beetle-attcked trees may be coppiced at ground level instead of being pruned. The pruned trees will be infected with brood lac in December 1938 or June 1939 as may be convenient when the shoots are $2\frac{1}{2}$ to 3 years old. The brood will be obtained from the Vannathiparai farm and the infection will be carried out as described for Kusum trees.

It costs Rs. 3 to 4 to prune a hundred *Shorea* trees in North Salem.

The formation of a *Shorea Lac Farm* will be decided on the result of this experiment.

767. *Fire protection.*—The Vannathiparai lac area is situated on the plains where the forest floor is practically devoid of grass : the locality is therefore not subject to fires in normal years. The surrounding grassy hills will be protected from fires in accordance with the prescriptions laid down in Chapter XI of this Working Plan, paragraph 799. The Karandamalai lac area will be fire protected under the prescriptions contained in paragraphs 789 and 790 of the same Chapter. No special fire protection measures other than those prescribed above are considered necessary in the interests of lac cultivation.

CHAPTER X.—WORKING PLAN FOR THE PROTECTION WORKING CIRCLE (INACCESSIBLE AREAS AND CLIMATIC FORESTS).

768. A statement showing areas of forests in the Madura division not included in any of the Working Circles prescribed in this plan is given below :—

Range.	Total area of reserves in acres.	Area of inaccessible and climatic forests in acres.
1 Sholavandan	54,260·96	13,828·41
2 Natham	67,837·34	8,513·19
3 Aiyalur	52,851·05	2,923·64
4 Kodaikanal	105,870·47	62,537·56
5 Palni	74,196·28	24,316·48
6 Cumbum	41,825·37	9,307·87
Total ..	**396,841·47**	**121,427·15**

769. The areas indicated above will not be exploited for timber, fuel or bamboos, but grazing of cattle, collection of minor produce and cultivation of cardamoms will be permitted, under the rules in force from time to time. (Vide paragraphs 395 and 398 of this Working Plans.)

CHAPTER XI.—MISCELLANEOUS PRESCRIPTIONS.

SECTION 1.—FINAL DEMARCATION.

770. The final demarcation of reserves not so demarcated according to the boundary description under section 16 of the Madras Forest Act should be taken up and completed as early as funds permit. Before the demarcation is taken on hand the existing boundary should be checked against the notified one and any discrepancies should be reconciled. The subjoined statement exhibits the reserves to be finally demarcated and the estimated cost of such demarcation :—

List of reserves to be permanently demarcated.

Serial number and name of reserve.	Length of boundary in miles.	Number of cairns as per S.I. sheet.	Number of inter-mediate cairns.	Approximate cost of demarcation.	Remarks.
				RS.	
NATHAM RANGE.					
1 Chinnapatti karadu ..	8·06	97	..	250	
2 Nedunkuttu	7·31	203*	..	500	* Intermediate cairns included in the totals.
3 Vellimalai-Nedumalai ..	8·94	114	20	400	
KODAIKANAL RANGE.					
1 Murugamalai	20·83	170	82	700	The present boundary on the ground agrees with the village map and so the reserve appears to have been finally demarcated.
2 Kuthukal Kadu	0·31	2	1	20	Only the Bodinayakanur common boundary requires demarcation.
3 Keelanavayal	2·39	15	..	80	Only the boundary adjoining unreserves needs to be demarcated.
4 Parappar	0·75	13	..	30	
5 Poombarai (Wattle plantation).	0·80	..	..	20	
6 Gundar Valley Extension ..	5·25	..	..	300	

NOTE.—No rocord of any demarcation for reserves under Kodaikanal range.

SECTION 2.—DISRESERVATION.

Paragraphs 771 to 772 deleted.

SECTION 3.—BOUNDARIES OF RESERVES.

774. It has been mentioned in chapter I of part I, paragraph 28, that the boundaries of many reserves as they have been demarcated on the ground do not tally with those marked on the Survey of India maps. Where the boundaries form the external limits of fuel felling series, they have been largerly found to agree with Revenue Survey maps. In all such cases the boundaries have been marked on the Survey of India maps by reducing the Revenue Survey maps to the proper scale and making suitable adjustments. Their degree of accuracy is therefore subject to the limitations of the procedure outlined above.

775. It was also noticed that the boundaries of certain reserves did not agree in places with their descriptions according to the respective notifications under section 16 of the Forest Act. The reconciliation of these differences was taken up in 1933 by Mr. C. M. Kushalappa, Extra Assistant Conservator of Forests, who prepared amended notifications in the case of some seven reserves in the Natham range.

The validity of such amended notifications was examined by Government who have been advised that, under the existing law, they would not be valid unless the formalities laid down for reservation were complied with. The Government therefore decided that the boundaries may continue to be as they now are, until the Forest Act has been suitably amended.

Suitable amendments to the Madras Forest Act have now been brought by Government before the Legislative Council. When the bill has been passed into law steps should be taken to renotify the boundaries of reserves so as to agree with the actual boundaries on the ground.

776. Enclosures which were not admitted at the time of forest settlement, or which have not been suitably demarcated, were found in the Thoppaswamimalai, Tannirkaradu, Panjanthangi and Mungilkaradu reserves. Steps should be taken to get them properly demarcated and settled.

777. A statement of discrepancies noticed by the Working Plan party is given in Appendix I. The statement will be found useful at the time of renotification of boundaries.

SECTION 4.—MAINTENANCE OF BOUNDARIES COMMON TO ZAMINDARIS.

778. There are a number of zamindaries in the Madura division adjoining reserved forests. The total length of common boundaries between Government forests and zemindari tracts is about 271 miles.

779. The question of maintaining these common boundaries was considered in 1929. The Doddapanayakanur zamindar stated that he would himself maintain his common boundary and the Marungapuri zamindar has not sent a definite reply : the other zamindars have agreed to meet half of the cost of clearance of the line with which each one is concerned.

780. The statement given in Appendix II exhibits, by ranges, the length of common boundary in each reserve and the portion of it that requires upkeep. Portions which require no maintenance, such as streams and watersheds, have been excluded.

781. The boundaries prescribed for maintenance in the foregoing statement will be cleared once in five years. The cost of clearance will usually be shared equally by the department and by the concerned zamindaris : most of the zamindars have agreed to this.

SECTION 5.—FIRE-PROTECTION.

782. The history of fire-protection detailed under section 4 of chapter V of part I, shows that (*a*) the fuel forests of the division are more or less free from the danger of extensive fires, except at their upper limits where the tree growth is sparse and grass prevails, and where zamindari forests adjoin the reserves, (*b*) the deciduous forests above the Fuel Working Circle are subject to incendiarism by graziers, pedestrians and collectors of minor forest produce and to fires spreading into them from adjoining forests, zemindari or State and (*c*) the sholas of the Upper Palni plateau, which play a prominent part in conserving the water supply of a large tract of irrigated land, are in danger of being seriously damaged by fires in the Ampthill Downs Reserve in which certain villages enjoy the privilege of free grazing and unrestricted firing of the grass.

783. Proposals for future fireprotection are based on the facts mentioned above and are as follows :—

(*a*) No special fire-protection measures are prescribed, in general, for areas under the Fuel Working Circle, but adjoining zemindari boundaries will be "early burnt" in December-January, as early as possible.

(*b*) The deciduous forests above the Fuel Working Circle will be protected, generally, by firetracing frequented rights of way, closing certain areas completely to grazing, prohibiting the collection of minor forest produce from other specified areas or collecting it departmentally and by early burning of fire lines.

(*c*) These measures by themselves cannot, however, put a stop to fires in areas where grazing prevails, as is the case in an overwhelming proportion of our deciduous forests. Graziers burn the forests for the sake of the flush of tender grass which comes up with the first rains after a burn. It is known that fires are as injurious to the grass growth as to the trees since the finer species of grass get killed off by fires. As it is impossible to punish every incendiary, wilful burning of forests may be checked only by removing the temptation to burn by closing the burnt area *immediately* to grazing, as a *silvicultural measure* intended to enable the area to recover from the damage caused by the fire *to the trees as well as to the grass*. This can be done under G.O. Ms. No. 1816, Development, dated 25th October 1929 in which areas which have to be specially protected may be closed to grazing ; burnt areas certainly require special protection temporarily. In this connection the following Proceedings may be perused with advantage :—

(1) B.P. (Forest) No. 76 of 24th March 1905.
(2) B.P. (Forest) No. 144 of 8th July 1905.
(3) B.P. (Forest) No. 264 of 28th November 1905, and
(4) C.C.P. (Misc.) No. 322/31 of 8th August 1931.

If the District Forest Officer is satisfied that the damage caused by a forest fire is sufficiently extensive or intensive to require the closure of the area as *a silvicultural measure*, he will obtain the sanction of the Collector, to close the area for such period as may be necessary, with *as little delay as possible*. It must be borne in mind that the closure should be applied before the new flush of grass shoots forth so as to deprive the culprits of their objective. With the facility of communication that obtains in this district it should be comparatively easy to obtain the Collector's sanction expeditiously.

In bad cases the sanction of the Government may be obtained to enhance the grazing fees, temporarily, and this may be found to be more effective.

Pens may be closed by the District Forest Officer without reference to the Collector, if areas adjoining them have been burnt seriously: no refund of penning fees may be claimed in such cases.

(*d*) A Part II scheme for protecting important sholas on the Upper Palnis, by growing a fire resistant belt of wattle round their periphery, was sanctioned by Government in 1933. A revised scheme is now proposed under which a few more sholas have been included but the cost has been considerably reduced.

784. Detailed proposals for future fire-protection are given below for each range.

Sholavandan Range.

785. The existing practice of earlyburning lines a hundred feet wide along the common boundaries between zemindari forests and Andipatty, Waguthumalai and Sirumalai reserves will be continued. The total length of such lines is 34½ miles and it is distributed as follows :—

	MILES.
(1) Andipatti South Reserve Forest	11½
(2) Waguthumalai Reserve Forest	1
(3) Sirumalai Reserve Forest	17
(4) Sirumalai North-West Reserve Forest	5
Total ..	34½

786. The early burning of a belt of 20′ width on either side of footpaths going up to villages on the Sirumalais, will also be continued every year. The total length of such paths is 10 miles. About a mile of the Malayur bridlepath between the zemindari boundary and the upper limit of the Endlaparai fuel series will also be treated on lines similar to those explained above. The paths to be firetraced are given below :—

	MILES.
(1) Thadaganachi footpath	3½
(2) Tenkal path from Anjukulipatti to Malayur through Madagamalai	2
(3) Tavasimadai-Vadakadu path joining at Kolikudumalai ..	1
(4) Ambathurai-Tolukadu path	1½
(5) Asalaiammankoil path to Malayur	1
(6) Dindigul-Malayur bridlepath	1
Total ..	10

Natham Range.

787. For the Alagar Hills, the existing practice of early burning of 15 miles of old firelines will be continued. It is also the practice to early burn all grassy areas on these hills. This will also be continued but particular attention should be paid to grassy areas within easy reach of the Alagar temple, as fires appear to have spread outwards from it in the past.

788. The upper slopes of the Perumalai Reserve Forest have been subject to fires in the past. The firetracing of the path leading from Sathambady to Malayur was prescribed in Mr. Wilson's plan but does not appear to have been done. This path, as well as that from Lingavadi to Malaiyur, will be firetraced to a width of 20 feet on either side, where they pass through grass. The total length of these paths which requires to be firetraced is about 2 miles.

789. The current practice of early burning grassy patches on the Karandamalais does considerable damage to standing sandal trees, among other species, and effectively checks the natural spread of sandal. It is also apprehended that the villagers living in the Karandamalai plateau do not receive wages commensurate with the labour they are called upon to supply. The following scheme of fire-protection will therefore be tried as an experimental measure for a period of three years, at the end of which it may be modified or discontinued, under the orders of the Conservator, if it prove unsatisfactory.

The villagers of Periamalayur, Chinnamalayur and Valasai will be held primarily responsible for the fire-protection of the Karandamalai plateau. They have expressed their willingness to accept this responsibility on the conditions set forth hereunder :—

(1) The undermentioned paths will be early burnt every year by the villagers to a width of 20′ on either side. The work will be done under departmental supervision and should be completed at the proper time in December or January.—

Number and name of path.	Distance in chains.
1 Malayur-Sengurichi	325
2 Malayur-Valasai	135
3 Malayur-Kalanai	180
4 Malayur-Kuttur	155
5 Valasai-Manakattur	160
6 Chinnamalayur-Manakattur	105
7 Chinnamalayur-Alampatti	65
8 Chinnamalayur-Aiyankoil	65
9 Chinnamalayur-Kuttupatti	120
Total ..	1,310

(2) The periphery of the sandal area on the Malayur-Jhandamedu path will be early burnt to a width of one chain all round, in the manner prescribed above. The length of this periphery is about 200 chains. The total length to be firetraced thus amounts to about 20 miles, allowing for gradients.

(3) The whole of the Karandamalai plateau above the upper limits of the Fuel Working Circle will then be placed in charge of the three villages mentioned above and they will be strictly held responsible for any fires that may occur in the area or spread into it from outside, as well as for illicit fellings inside it.

(4) If, at the close of the fire-season, the District Forest Officer is satisfied that there have been no fires over the area, or that the villagers have so promptly extinguished any fires that may have occurred, that the damage caused was negligible, and that there have been no illicit fellings, the villagers will be rewarded by the refund of a portion of the grazing fees paid by them. The refund will be paid by the District Forest Officer in person or by his gazetted assistant.

(5) The average annual grazing revenue realised from the three villages works out to about Rs. 275, for the past three years. The villagers will be granted a refund of half the grazing fees realised in the previous year i.e., about Rs. 140, for the firetracing work prescribed above followed by entirely successful fire-protection and protection from illicit fellings. The refund is entirely at the discretion of the District Forest Officer who may withhold the whole or such part of it as he deems fit, depending on the results of protection achieved during the year.

790. The cost of firetracing about 20 miles of paths is about Rs. 80 at Rs. 4 a mile. The villagers stand to gain about Rs. 60 therefore, for the general protection they will be responsible for. The average annual expenditure on fire-protection of the Karandamalais has been Rs. 146 in the past. The present proposal will not therefore cost the department any more, but is expected to ensure that the villagers actually get what is due to them as wages for work done, and at the same time afford satisfactory protection to the plateau against fire and illicit cutting.

Palni Range.

791. The following paths will be early burnt to a width of 20 feet on either side :—

(1) The bridlepath to Pachalur from where it leaves the Parappal plateau up to where it enters the sholas near Pachalur—length about 3 miles.

(2) The old bridlepath from Velancombai to Vilpatti from where it leaves the upper limit of the Palni fuel felling series to the reserve boundary on the plateau—length 5 miles.

(3) The path to Puttur passing thorough the Kudiraiyar reserve—length 5 miles.

(4) The path to Kukkal through the Kudiraiyar reserve—length 5 miles and 4 furlongs.

792. The northern boundary of the Upper Palni unreserves where they adjoin Kudiraiyar, Olianuthu and Poombarai Vilpatti Valley reserves will be early burnt to a width of 100 feet—the length of this line is 26 miles.

793. The common boundary between the Madura and Coimbatore forest divisions need not be firetraced. The boundary between the Kudiraiyar reserve and the Rettayambadi mitta need not be firetraced either, as it is a stream for the most part, and bamboos abound in most places.

Aiyalur Range.

794. Six miles of the common boundary between the Thopaswamimalai Reserve Forest and the Kadavur zemindari forests are being early burnt at present. This will continue to be done.

795. Grassy portions of the Semmalai Reserve Forest are now being burnt in accordance with current practice. It is not necessary to firetrace grassy areas unless they happen to adjoin the common boundary between the reserve and the Kadavur zemindari forests.

The early burning will hereafter be confined to grassy portions adjoining the Kadavur zamindari forests.

Cumbum Range.

796. The following rights of way will be firetraced by early burning to a width of 20 feet on either side :—

(1) The bridlepath going up to the High Wavy Tea Estates. This requires to be traced for about 4 furlongs below Vekkalimarattu tholuvu and about 1 mile 4 furlongs above the Timber Working Circle.

(2) The path from Vannathiparai resthouse to Medagaranmettu, for a distance of about 1 mile and 4 furlongs, from the point where it starts going up the hill to where it enters the semi-evergreen type of forest.

(3) The path to Chellakoilmettu where it passes through grass—length about 1 mile and 2 furlongs.

(4) The path to Cumbum mettu, where it passes through grass—length about 2 miles.

(5) The path to Ramakkal mettu where it passes through grass—length about 1 mile and 4 furlongs.

(6) The path to Mangaladevi temple, where it passes through grass—length about 2 miles.

(7) The Kumli ghat road, for a distance of about 4 miles : this will be firetraced to a width of 100 feet on either side.

797. The best timber forests of the range are situated between the Suranganar valley on the west and the Surulipatti plateau on the east.

798. The Surulipatti plateau will be specially fire-protected by fire-tracing a fifty-foot wide fireline along its western edge. This has been shown on the working plan maps.

The line will closely follow the existing fireline for the most part but in the northern end, instead of following this old line along the High Wavy bridlepath, it will run along the ridge from Vekkali-marathu-tholuvu up to where it meets the Anaigajam stream and thence along the southern bank of Anaigajam for a length of 6 furlongs ; and also from the Venniar crossing, instead of following the ridge to Maharajamettu, the boundary will run along the southern bank of Venniar over a distance of 2 miles.

799. The remaining part of the important timber forests is subject to fires which cross over from the forests of the Travancore State. Every effort will be made to prevent these fires from getting across by early burning the frontier boundary between Vattathotti on the east and Chellakoil mettu on the west. The length of the frontier boundary between these two points is 16 miles and most of the fires coming over from Travancore cross over between these two points. No difficulties are anticipated in getting this work done, as it was the practise till 1930 to early burn the full length of $33\frac{1}{2}$ miles of the Tranvancore frontier line. The early burning of this portion of the frontier boundary, combined with the firetracing of the paths passing through the forests, is expected to afford reasonable protection from fire to this important area.

800. The fire-protection of the Surulipatti plateau is particularly important in view of the teak plantations which it is proposed to make on it and the regeneration operations which will follow the selection fellings. Two fire patrols should be employed during the fire season whose duty it will be to keep the main fireline and the subsidiary lines prescribed round the plantations (vide paragraph 495, the Clearfelling Working Cirlce) swept and burnt as necessary. The fire-protection of the Kombai sandal area has been prescribed under the Sandal Working Circle.

Kodaikanal Range.

801. The Law's ghat road (motor road to Kodaikanal) will be firetraced to a width of 100 feet on either side for a total distance of about 14 miles. At present eight miles are being firetraced. The portion from the 15th mile to the Forest Guard's quarters at Perumalmalai (about 6 miles) must also be firetraced hereafter, in order to protect the Perumalmalai reserve and other adjoining areas. Lengths passing through sholas will not be firetraced, however.

802. The Coolie ghat road will continue to be firetraced as at present, to a width of 100 feet on either side, for a length of 4 miles and 3 furlongs.

803. The undermentioned footpaths from the plains to hill villages will be early burnt to a width of 20 feet on either side, where they pass through grass ; the approximate lengths required are indicated below :—

(1) To Periyur .. .. 5 miles.
(2) To Vellagavi .. .. 2 miles.
(3) To Adukam .. .. 2 miles.

The Upper Palni Sholas.

804. The undermentioned sholas on the Upper Palnis will be taken up for special fire protection, the rest (given in Appendix III) being considered as too degraded to be worth restoring :—

Sholas to be fire-protected.

Reserve.	Name of shola or plantation.	Length of boundary. M.	F.	CH.
Ampthill Downs Reserve.	1 Vandaruvu pine plantations and sholas	1	7	4½
	2 Vandaruvu hill shola	0	6	0
	3 Eduvakadu shola	1	7	9½
	4 Pallankadu shola	0	5	7
	5 Varankanal shola	1	0	7
	6 Siruvilan kadu	2	1	8½
	7 Chinna siruvilan kadu	2	0	0
	8 Karuppankadu	1	7	7¾
	9 Golusu odai shola	1	1	9
	10 Valley hill	2	1	9½
	11 Pukadu	0	7	9¾
	12 Adithikadu	0	6	0
	13 Madakadu	2	2	3½
	14 Manthan kadu	0	5	5
	15 Marianshola—2 bits	3	7	8
	16 Koravanthotti shola—2 bits	2	4	0
	17 Kolavarai shola	0	7	7
	18 Patturkanal	3	3	6
	19 Chinnapattur kanal	1	4	0
	20 Talavasakanal	0	5	6
	21 Sembilerikanal	1	1	6
	22 Nedunkanal	1	5	8
	23 Karadiparaikanal	1	7	3
	24 Kombuthooki kanal	0	3	9
	25 Chandanaparai	0	4	0
	26 Gundanpoochikanal	2	4	3
	27 Avarampallam	0	4	8
	28 Asanthur kanal	0	4	7
	29 Nariyanagar shola	2	1	9
	30 Lower portion of Nariyanagar shola	2	0	0
	31 Chunnambukadu	2	0	3
	32 Karumpuraikanal	1	0	0
	33 Poochootti shola	2	0	0
	Total	51	6	4
Gundar Valley and Gundar Valley Extension.	1 Vembadi shola	2	1	7
	2 Pallankadu	1	7	4
	3 Velankuli	1	5	5
	4 Kakkathorai (Kakkathanni)	0	5	4
	5 Varankanal	0	7	2
	6 Purankanal	0	4	7¾

Sholas to be fire-protected—cont.

Reserve.	Name of shola or plantation.	Length of boundary. M.	F.	CH.
	7 Pugula kanal	1	4	7
	8 Melchimittan kanal	1	2	2
	9 Mada kanal	1	1	0
	10 Peria karumbankadu	1	0	3
	11 Perun kanal	4	2	0
	12 Kolikadu	1	1	5
	13 Chandanam	0	5	2
	14 Manavaratan kanal	1	4	0
	15 Sirum kanal	0	6	0
	16 Parappar	1	3	0
	17 Gundan shola (Eucalyptus plantation)	1	4	0*
	18 Pannithulam kanal	0	5	5
	19 Kundukadu (Mullukanal)	2	3	1
	20 Edamanal shola	0	5	3
	21 Mondikileri	0	6	6
	22 Gundar block, consisting of Melagiri kanal, Melvariyan and Keelvariyan kanal.	4	0	0
	23 Kolavipatty shola	1	0	0
	24 Kuppathevan shola	1	2	0
	Total	35	0	3¾
Tiger shola	1 Tiger shola	8	4	0
Perumalmalai	2 Perumalmalai shola	2	1	0
Kilanavayal	3 Kilanavayal shola	3	7	0
Swamikanal	4 Swamikanal, I and II	10	1	0
Kukkal	5 Kukkal	6	0	0
Gundar valley	6 Pine plantations	8	4	0
	7 Talakadu kanal	2	6	0
	Total	41	7	0
	Grand total	128	5	7¾

805. The total length of boundaries of all sholas proposed to be taken up for special protection is 129 miles, approximately.

806. It is proposed to grow a belt of the Australian wattles, *Acacia decurrens, Acacia dealbata* and *Acacia meulanoxylon*, 24 feet wide, ultimately, round the edge of the sholas so as to form a live belt which would be proof against fire.

807. The supply of labour on the hills is limited and the sholas are often far away from the villages. The work will therefore be spread over 20 years, at the rate of about 6½ miles per year.

808. The sholas already have round them a scraped line at a distance of about a chain or two from their edge and *outwards* from *this scraped line the grass is burned off annually.* The live belt of wattle will be raised just inside this scraped line by sowing seeds on prepared beds.

809. On sloping ground, the beds will be arranged in lengths of 8 feet along the contour : on level stretches, they will run along the boundary.

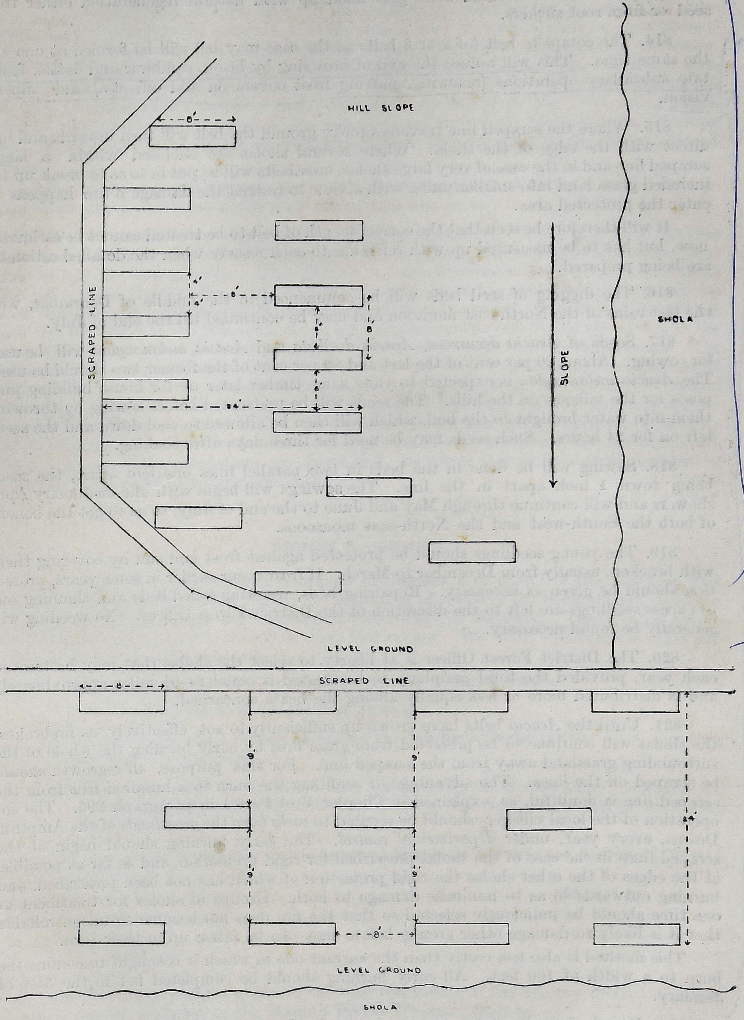
810. The beds will be 2 feet wide with nine inches of worked soil free of grass roots and stones, the lower edge being supported by turf and any stones picked out of the beds.

811. There will be two parallel belts of beds on sloping country, the two belts being separated by a width of 8 feet. On the level, there will be *three* parallel belts of beds, the distance between adjacent belts being nine feet.

On slopes the horizontal distance between two adjacent beds in the same belt (which will be at different levels) will be 8 feet from centre to centre, i.e., 6 feet between edges. The beds in one belt will be arranged so as to alternate with those in the next.

* The rest of the Gundan shola Eucalyptus plantation is protected by a belt of wattle.

812. The arrangements are illustrated in the diagrams given below :—



813. The total breadth of the wattle belt will be 24 feet ultimately, when the intervening space between treated belts gets filled up with natural regeneration either from seed or from root suckers.

814. The complete belt (of 2 or 3 belts as the case may be) will be formed at one and the same time. This will reduce the evil of browsing by bison, sambhur and cattle, facilitate subsidiary operations (resowing, putting frost covers on and off, etc.) and supervision.

815. Where the scraped line traverses rocky ground the belt will turn inwards and link direct with the edge of the shola. Where several sholas are enclosed within a single scraped line and in the case of very large sholas, crossbelts will be put in so as to break up the included grass land into smaller units, with a view to restrict the damage if fire happens to enter the protected area.

It will therefore be seen that the correct length of belt to be treated cannot be estimated now, but has to be measured up with reference to each reserve when the detailed estimates are being prepared.

816. The digging of seed beds will be commenced in the middle of December, with the last rains of the North-east monsoon and may be continued till the end of July.

817. Seeds of *Acacia decurrens, Acacia dealbata* and *Acacia melanoxylon* will be used for sowing. About 20 per cent of the last and 80 per cent of the former two should be used. The *Acacia melanoxylon* is expected to yield some timber later on for house building purposes for the villages on the hills. The seeds will be pretreated before sowing by throwing them into water brought to the boil, which will then be allowed to cool down and the seeds left on for 24 hours. Such seeds may be used for three days after soaking.

818. Sowing will be done in the beds in two parallel lines one foot apart, the seeds being sown 1 inch apart in the line. The sowings will begin with the customary April showers and will continue through May and June to the end of July, so as to get the benefit of both the South-west and the North-east monsoons.

819. The young seedlings should be protected against frost and sun by covering them with bracken, usually from December to March. If frost occur earlier in some years, protection should be given as necessary. Repairing beds, resowing failed beds and thinning out of excess seedlings are left to the discretion of the District Forest Officer. No weeding will generally be found necessary.

820. The District Forest Officer is at liberty to select the sholas that may be treated each year, provided the total periphery to be treated is equal to $6\frac{1}{4}$ miles approximately and is distributed more or less equally among the beats concerned.

821. Until the *Acacia* belts have grown up sufficiently to act effectively as firebrakes, the sholas will continue to be pretected from grass fires by early burning the whole of the surrounding grassland away from the scraped line. For this purpose, all regrowth should be scraped off the lines. The advantage of confining the burn to a hundred feet from the scraped line is doubtful, as explained in Chapter V of Part I in paragraph 295. The co-operation of the local villagers should be secured to *early burn* the *grasslands* of the Ampthill Downs, every year, under *departmental control.* The early burning should begin at the scraped lines in the case of the sholas prescribed for rigid protection, and as far as possible, at the edges of the other sholas the rigid protection of which has not been prescribed, and burning outwards so as to minimise damage to both. Groups of sholas for treatment at one time should be judiciously selected so that the fire does not become so uncontrollable that it is likely to damage other groups before they can be taken up in their turn.

This method is also less costly than the current one in which it is sought to confine the burn to a width of 100 feet. All early burning should be completed before the 31st of January.

822. *Record of results of fire protection.*—(1) In the year 1918, Mr. P. M. Lushignton prepared a series of watercolour sketches of certain sholas of the Upper Palnis which exhibit the evil effects of annual fires on the catchment areas of important streams. There are no records to show from which spot each of these interesting views was sketched. The writer has been able to locate the spots for seven of these sketches and these have been noted on the backs of the sketches themselves. Photographs of these sholas have been taken by the writer in the summer of 1935 from the located spots. The sketches and photographs have been filed with the Working Plan records.

A comparison of the sholas pictured in those sketches with their actual present condition and the recent photographs, distinctly shows that sholas which were left unprotected from fire (like Avarapallam, Vannampatti and Sholashcriar) have deteriorated

considerably since 1918, whereas the Kukkal shola, which has been under special fire protection, has shown a decided tendency to expand.

(2) Photographs of some more of the important sholas of the Upper Palnis were taken by the writer in the summer of 1935, with a view to form records of their present condition for comparison with their condition at any future time as a result of protection from fire or lack of it. The exact spot from which each photograph was taken has been noted on the back of the concerned print. Twenty four of these views were considered suitable for enlargement and have been enlarged to the full plate size. One set of copies of the original photographs and of the enlargements have been filed with the Working Plan records, and a second set of enlargements has been supplied to the District Forest Officer.

A list of the enlarged photographs is given in Appendix IV, together with the description of the exact spot from which each photograph was taken.

823. *Fire protection by means of belts of coffee plantations.*—The villagers of Kukkal have been asking for the lease of the grass land included in the Swamikanal reserve, near their village, for raising coffee. They propose to raise *Grevillea robusta* first and then plant the coffee under the *Grevillea*. If a belt of grassland about five chains wide be planted up with *Grevillea* and coffee round the sholas of Swamikanal reserve, the planted belt will act as a live fire brake in the same manner as the proposed wattle belt round the sholas in the Ampthill Downs. It will, in addition, be a source of revenue to the department. The villagers were consulted about this by the writer and they expressed their willingness to plant up belts round the sholas. The leasing out of belts about five chains wide round the sholas of Swamikanal reserve for the purpose of planting coffee is therefore recommended for further consideration. Only *Grevillea robusta* and other longlived species may be raised as nurses. Shortlived species like *Erythrina lithosperma* should not be permitted, for in case any of the plantations are abandoned, we would then have a permanent belt of trees on the ground adjoining the shola.

SECTION 6.—GRAZING.

824. It will be observed from Section 3 of Chapter V of Part I of this Working Plan that the existing provisions in regard to the grazing of cattle in the Sholavandan, Natham, Ayyalur and Palni ranges have worked satisfactorily, in the main. Therefore no change in the existing practice is proposed in these four ranges. We shall recapitulate these provisions for the sake of convenience :—

(1) Goats shall be entirely excluded from all reserved forests.

(2) All sandal areas shall be closed to grazing.

(3) Fuel coupes shall remain closed to grazing for a period of ten years including the year of exploitation.

(4) No sheep shall be admitted into the reserves of Sholavandan, Natham and Ayyalur ranges (excluding that portion of the last range which lies in the Trichinopoly district).

(5) The rates for grazing in the reserved forests of the revenue district of Madura shall be :—

	RS.	A.	P.
Sheep	0	6	0
Cows	0	12	0
Buffaloes	1	8	0

(6) The rates of grazing fees in the reserved forests of the revenue district of Trichinopoly, included in the Madura Forest Division, shall be :—

	RS.	A.	P.
Sheep	0	8	0
Cows	1	0	0
Buffaloes	2	0	0

825. The lower rates of grazing fees prevailing in the major part of the Kodaikanal range have been discussed in detail in section 3 of Chapter V of Part I of this Working Plan. The reasons in favour of raising these rates to the level that obtains in the rest of the Madura district (and the rest of the Kodaikanal range, for that matter) have also been mentioned therein. It is therefore recommended that Government may be requested

once again to enhance the lower rates now current to the level that prevails elsewhere in the Madura district. If a sudden rise to this latter level be considered to be too drastic the rates may be gradually enhanced to this level in four successive years.

826. The demand for pens inside the reserved forests of the Cumbum range has also been referred to in Section 3 of Chapter V of Part I. The prohibition of penning in our reserves has driven a considerable number of cattle into the adjoining Travancore State and elsewhere with the result that our reserves are undergrazed. Fires in the Cumbum range are therefore more destructive than in other ranges. The demand for pens in the reserves of the Cumbum range is keen.

As a result of the prohibition of pens inside our reserved forests, we gather none of the advantages of penning while at the same time we do not escape its evil effects, for some of the pens in the Travancore State almost touch our common boundary. It is therefore proposed that the following four pens be opened in the reserves of the Cumbum range, the maximum number of cattle that may be penned in each of the specified localities being as shown against each : the number has been fixed with reference to the grazing area available round each pen, allowing three acres per cow unit.

Name of the pen proposed.	Reserve in which situated.	Maximum number of cow units fixed.
(1)	(2)	(3)
1 Vellaparai tholuvu	Kombai	350
2 Kottamalai tholuvu	Kombai	600
3 Ambugajam—Anaigajam saddle	Surulipatti	400
4 Venniar tholuvu	Vannathiparai	350

A penning fee not exceeding Rs. 5 per 100 heads of cattle or less may be fixed in each case.

827. The Surulipatti plateau of the Cumbum range is primarly a timber bearing area and has consequently been under special fire protection for a long time. Our efforts in this direction have not met with much success, however, as the area is open to grazing and to the collection of minor forest produce by lessees. Unless grazing and collection of minor produce by lessees are prohibited inside the area it will be impossible to prevent the occurrence of fires in it. The collection of minor produce from the Surulipatti plateau will be made under departmental supervision in accordance with the prescriptions under Chapter VIII of Part II of this Working Plan. That part of the Surulipatti plateau which is under special fire protection should also be closed to all grazing.

828. The demand for grazing in the reserves on the eastern slopes of the Cumbum valley is confined to five villages—Kamayagowdanpatti, Narayanathevanpatti, Surulipatti, Karunakaramuthanpatti and Kullappagowndanpatti. These villages graze their cattle in the Surulipatti section, the area of which is some 10,000 acres, out of which about 6,300 acres are accessible to grazing. The average number of cattle licensed annually to grazing in this area for the last 15 years is 1,600 cow units, in round figures, out of a total number of 4,000 units in the villages concerned. The incidence of grazing has therefore been nearly 4 acres per cow unit.

The area of the Surulipatti plateau now proposed for closure is about 2,250 acres. On account of its distance from the villages this area is not much frequented by cattle which largely graze along its outer slopes and fringes.

At four acres per cow unit, the maximum number of cattle that may have to find grazing elsewhere when the Surulipatti plateau is closed will be about 500. In actual practice this number will be much smaller and can be accommodated over the rest of the area open to grazing. In case any hardship be felt, however, it is proposed to open two pens in the Surulipatti section, one at Ambugajam-Anaigajam saddle which will accommodate a maximum of 400 head of cattle and the other at Venniar to accommodate up to 350 head. The opening of these pens will enable cattle to graze in areas hitherto inaccessible on account of their distance and should be hailed as a boon by the villages concerned.

829. The "Venniar" is likely to run dry, however, in the hot season during years of scanty rainfall. Access for cattle penning at "Venniathutholuvu" to the Surulipatti stream should be granted in such season along the Tamarajonai—Arisiparai road running through the closed area, which road should then be fire traced effectively to a width of one chain on either side.

830. The timber forests of the Surulipatti plateau have degenerated considerably as a result of annual fires and illicit fellings for which the fact that it has been long open to grazing has contributed not a little. If the area be not protected by closure to grazing it is bound to degenerate into an inferior type fit only for firewood. Also, unless it be

closed to grazing, it would be difficult to ensure the fire protection of the teak plantations prescribed under the "Clearfelling Working Circle", and impossible to bring up any gap regeneration prescribed under the "Selection Working Circle." In the best interest of the local population, whose demand for timber in this fertile valley will always be keen, the Surulipatti forest should therefore be freed from the dangers of grazing.

831. There is no demand for pens elsewhere in the division, except in the Ampthill Downs reserve in which the surrounding villages enjoy the privilege of free grazing and firing of grass ; it is obviously undesirable to allow further liberties in this locality.

Miscellaneous prescriptions.

832. It is desirable that the existing tanks, wells and springs should be kept in good repair by the department. Such repairs should therefore be carried out as and when necessary. The water sources which require particular attention have been noted in the "Remarks" column of the statement given under paragraph 519 of the Fuel Working Plan.

833. In pursuance of Recommendation No. 1 of the Royal Commission on Agriculture, the removal of *fodder grass* will be permitted *free*, on *headloads* only, from any part of a reserved forest, open or closed to grazing, except from areas closed to grazing on account of damage from fire.

SECTION 7.—THINNINGS IN THE KODAIKANAL PINE PLANTATIONS.

834. The history of the Kodaikanal pine plantations given in Chapter V of Part I of this plan discloses that they have not been thinned at all ever since their formation. The trees in the area planted at an espacement of 6′ × 6′ have suffered more in consequence of this neglect than those planted 9′ × 9′ or 12′ × 12′. Many of the trees are slender and are leaning against one another, and a large number have been blown down by strong winds after the disastrous fire of 1920. The crying need for thinning is perhaps the most obvious feature that strikes one about these plantations, besides the urgency of disposing of the mass of dead trees in their midst, which in addition to their inflammability detracts from the beauties of a hill station.

835. Efforts to dispose of the dead pine did not meet with much success till two years ago. For the last 2 years, however, an appreciable quantity has been disposed of on permits sold to consumers, and there is reason to hope that this demand will continue. As soon as the major portion of the dead pine has been sold in this manner thinnings should be taken up in the plantations.

836. The subjoined statement exhibits the areas which require to be thinned, arranged in order of their urgency : thinnings should be conducted as far as possible annually and to such an extent as will allow of the quick disposal of the produce. The plantations have however been grouped together so as to allow of approximately equal areas to be treated every year, for a period of eight years.

Order of thinnings in pine plantations.

Order of thinnings.	Year of formation.	Block number.	Area of block in acres.	Total area in acres.
(1)	(2)	(3)	(4)	(5)
1	1910–11	I	9·17	47·62
		V	9·77	
	1911–12	II	28·68	
2	1909–10	II	0·15	49·08
	1910–11	III	0·25	
		IV	0·27	
		VIII	1·65	
		IX	1·10	
		X	6·38	
	1911–12	I	12·48	
		III	2·90	
		V	1·10	
		VI	3·90	
		IX	7·30	
		XI	11·60	
3	1910–11	XI	5·80	48·60
	1911–12	XVI	10·60	
		XVII	24·80	
		XIX	1·20	
		XX	1·10	
		XXI	5·10	
4	1913–14	III & IV	55·00	55·00

Order of thinnings in pine plantations—cont.

Order of thinnings. (1)	Year of formation. (2)	Block number. (3)	Area of block in acres. (4)	Total area in acres. (5)
5	1909–10	III	0·22	
		IV	0·22	
		V	0·22	
	1910–11	II	0·27	
		VI	5·40	
		VII	2·20	
	1911 12	XII	8·30	45·53
		XIII	2·40	
		XIV	1·00	
		XV	0·70	
		XXII	7·00	
	1912–13	I *b*	17·60	
6	1911–12	XXII	0·40	
		XXIV	7·60	
	1912–13	I *a*	22·50	49·50
	1913–14	VIII	5·50	
		X	13·40	
7	1906–07	II	12·37	
	1913–14	IX	33·10	45·47
8	1906–07	I	22·25	
		III	0·27	
		IV	3·40	
	1909–10	I	5·10	44·37
	1910–11	XII	3·00	
	1912–13	I *c*	4·92	
		I *d*	0·43	
	1921	I	5·00	
			Total ..	384·97

SECTION 8.—ROADS, PATHS AND BRIDGES.

837. *Repairs.*—The existing roads and paths shall be maintained as at present : provision has been made for this in the Financial forecast on the basis of the average expenditure in the past.

Difficulty has been experienced in the past in the matter of obtaining in proper time the contributions of the District Board for the maintenance of certain roads. Steps should be taken to get the contributions well in advance of the season for repairs. Now that Taluk Boards have been abolished there should be less difficulty in the matter.

838. *Minimum width of roads.*—The undermentioned roads are less than 33 feet broad in some places. A minimum width of 33 feet is necessary and this should be borne in mind when executing annual repairs. Where necessary, sufficient extent of land should be acquired for the purpose.

1 Palamedu-Andipatti road varies from 27 feet to 56 feet in width.
2 Rajadhani-Uttappanayakanur road varies from 26 feet to 116 feet in width.
3 Sirumalai-Anjukulipatti road varies from 21 feet to 33 feet in width.
4 Aiyalur-Mungilkaradu road varies from 24 feet to 29 feet in width.
5 Aiyalur-Sengurichi road varies from 19 feet to 30 feet in width.
6 Aiyalur-Sendurai road varies from 14 feet to 60 feet in width.
7 Sendurai-Pillayarnatham road varies from 20 feet to 54 feet in width.
8 Sengurichi-Vadamadura road varies from 21 feet to 30 feet in width.
9 Kovilur-Thopaswamimalai road is 18 feet at 3 miles 3 furlongs.
10 Kuttupatti-Manakattur road is less than 30 feet in two places.
11 Sendurai-Kudagipatti road is less than 30 feet for 1½ chains at 5 mile 4 furlongs.
12 Sendurai-Manakattur road is less than 30 feet at 10 miles 2 furlongs, 12 miles 4 furlongs and 12 miles 5 furlongs.
13 Kalpatti-Puthanatham road varies from 15 feet to 35 feet in width.

Improvements and new construction.

839. *Cumbum Range.*—(1) The existing cart-track from Tamarajonai to Arisiparai on the Surulipatti plateau requires to be considerably improved by realignment and reconstruction in parts before any timber can be carted over it. This work is necessary to afford easy transport of produce from the coupes proposed on the Surulipatti plateau (length about 6 miles).

(2) A cart-track connecting the previous one to Surulipatti village will afford through communication with Cumbum or Uttamapalayam at all seasons. Carts have now to pass through patta lands and are therefore liable to be obstructed (length about 4 miles and 4 furlongs).

840. *Palni Range.*—(1) The existing ghat road from Oddanchatram railway station to the Parappal plateau is five miles in length. It has to be extended further in order to reach the more remote areas of the Virupakshi South Fuel series. The road does not at present serve the bamboo areas in the locality which are in consequence being worked only through headload tickets. An extension into the bamboo area will enable these bamboos to be worked more intensively and cheaply. It is probable that the bamboos may reach the Madura market then, and thus result in better prices being realised for the coupes. An extension of the present road by 6 miles is therefore prescribed.

(2) The Palni Municipality may be induced to complete the Pipe-line road from Palni town to the Velancombai Reserved Forest by the construction of culverts over the several streams across it. This will considerably improve extraction facilities from the Palni Fuel series, the P.V. Valley Bamboo series and the Velancombai teak plantations.

841. *Sholavandan Range.*—(1) The existing cart-track from Palamedu to Valayapatti is very sandy and loaded carts pass over it with difficulty. If it be improved better prices may be expected for the fuel coupes in the Anjukulipatti, Sirumalai East and Perumalai series. Since the track lies entirely outside reserved forests it is not proposed that the work should be undertaken by the Forest department. It is suggested that the District Board may be asked to take up the work : a portion of the cost may perhaps be borne by the Forest department as an inducement. The length of the road is about 4 miles and 4 furlongs.

(2) A cart-track was constructed by the department in 1931 from Konapatti village into the Konapatti Fuel series. The fuel from this series passes through Konapatti and Emakkalapuram villages into Dindigul. There is a road connecting Emakkalapuram with the Dindigul-Natham road, but the existing village track between Konapatti and Emakkalapuram is difficult to negotiate during the rainy season. This track, which is about 2 miles long, should be improved into a good cart-track so as to establish through communication at all seasons between Konapatti Fuel series and Dindigul.

(3) The hairpins on the ghat section of the Anjukulipatti cart-track require to be widened in order to enable carts to pass round them without danger.

842. *Natham Range.*—(1) The northern half of the ghat road in the Alagar Hill Reserve will have to be improved to enable the coupes in the Periaruvi Fuel series to be worked. A total distance of 4 miles may be repaired for about Rs. 400.

(2) The shortest route to Madura for fuel from Pottapatti series is via Sirugudi. The village track from Pottapatti to Sirugudi passes through patta land in places and this is a source of annoyance to fuel contractors and other persons who use it. Sufficient land should be acquired between the Karumalai and Vellimalai reserves to enable the whole track to be free from pattas.

843. *Aiyalur Range.*—(1) A cart road from Kalpatti chatram to Puthanatham passing through Kadapichampatti is necessary to facilitate the extraction and inspection of coupes in the Kumarikatti, Sigamkaradu, Sorupam, and Karpur-Reddiapatti reserves. This road will make the Puthanatham reserve also more easily accessible which is desirable as it is much subject to illicit fellings. A length of $2\frac{1}{2}$ miles from Kalpatti chatram has already been constructed, but the approach to it from the main Trichinopoly-Dindigul road is through the market place and is very obscure now : this approach is capable of improvement and should be attended to. The estimated total length is 11 miles, including the 2 miles 4 furlongs already constructed.

The existing cart-track has fallen into a bad state as fuel coupes in this locality have not been worked for the last twenty years.

844. The following roads are prescribed for construction in the order given :—

(1) Improvement and reconstruction of Tamarajonai-Arisiparai hill road in Cumbum range, 6 miles, at an estimated cost of Rs. 2,000.

(2) Extension of Oddanchatram-Vadakadu road into Parappal plateau, Palni range, 6 miles, at an estimated cost of Rs. 2,000.

(3) Extension of Konapatti road to Emakkalapuram, Sholavandan range, 2 miles, at an estimated cost of Rs. 500.

(4) Extension of Kalpatti-Puthanatham road, Aiyalur range, 9 miles, at an estimated cost of Rs. 3,500 (4 miles at Rs. 500 a mile and 5 miles at Rs. 300 a mile).

(5) Acquisition of land for Pottapatti cart-track, Natham range, Rs. 200.

(6) Improvements to Alagar ghat road, Natham range, 4 miles, Rs. 400.

845. The following roads are suggested:—

(1) Road from Palamedu to Valayapatti, Sholavandan range, 4 miles—A contribution of Rs. 1,000 may be given by the department if the District Board undertakes to do the work.

(2) Road from Surulipatti village to Tamarajonai-Cumbum range, 5 miles, estimated cost Rs. 1,500 including cost of acquisition.

(3) Broadening hairpins in Anjukulipatti-Valayapatti road, Sholavandan range Rs. 200.

(4) Improvement to the Palni pipe-line road: contribution to the Palni Municipality Rs. 500.

SECTION 9.—BUILDINGS AND WELLS.

846. The existing buildings should be kept in good repairs: the financial forecast provides for an average annual expenditure on repairs based on past actuals. Buildings which call for special repairs have been noted below.

847. There are 84 beats in the division and 19 foresters. There are at present not enough subordinates' quarters to accommodate all this staff. New subordinates' quarters are prescribed hereunder based on the urgency of requirements.

848. *Sholavandan Range.*—(1) The rest-house at Palamedu requires to be re-roofed with mangalore tiles. The existing roof of pan tiles over split bamboos is very insanitary and is in a state of decay. A garage has to be built: there is none at present.

(2) The roof of the rest-house at Rajagopalanpatti is of country tiles and is leaky on account of constant damage by monkeys. Mangalore tiles should be substituted for country tiles.

(3) Subordinates' lines are urgently required at Kalluthu and Theppathupatti: it is proposed to shift the headquarters of the Moruthu beat guard from Rajadhani to the latter place, in the interest of better protection—*vide* paragraph 874 (1).

(4) Lines for the beat subordinates should be built at Mettupattu, Valayapatti and Malayur, when funds permit.

849. *Natham Range.*—(1) There is no latrine attached to the range quarters: one should be provided.

(2) The accommodation in the subordinates' lines at Natham is very limited and is insufficient for the staff stationed at headquarters. The verandah may be enclosed and converted into a kitchen. One more room is necessary to accommodate the full staff.

(3) Subordinates' lines are urgently required at Manakattur, Velayudhanpatti and Lingavadi.

(4) When funds permit, lines should be built at Sathambadi, Kasampatti and Mulaiyur also.

850. *Aiyalur Range.*—(1) The accommodation in the subordinates' quarters at Aiyalur is insufficient. The addition of verandahs to the Forest guards' and peon's quarters will provide the extra accommodation that is necessary.

(2) The rest-house at Pillayarnatham requires extensive repairs as the wood work has been seriously attacked by white ants. The wall in front of the stables should be knocked down to enable a motor car to be accommodated in it.

(3) The quarters at Manaparai should be so subdivided as to provide accommodation for two subordinates.

(4) The watcher's shed at Kalpattichatram should be improved by adding a verandah to it.

(5) New lines are urgently required at Sekkanam, Kadapichampatti and Puthanatham for the beat guard and watcher at each place.

(6) A rest-house at Kadapichampatti will facilitate the inspection of Karpur-Reddiapatti, Kumarikatti, Sorupam and Puthanatham reserves and will help to keep the proposed Kalpattichatram-Puthanatham road in order. Quarters will be required here for one forester also.

(7) Lines for the beat subordinates should be provided at Pusaripatti and Togamalai, when funds permit.

851. *Kodaikanal Range.*—(1) The accommodation for the range clerk at Kodaikanal is insufficient: the addition of a kitchen to the present building is considered necessary and sufficient. Quarters for the forester at Kodaikanal are also desirable as he finds difficulty in obtaining suitable accommodation in the town.

(2) There is at present no accommodation for the subordinates of the two beats whose headquarters are at Pulathur. In the interests of protection of sandalwood round Pulathur it is essential that these subordinates should live at Pulathur. Subordinates' lines to accommodate two forest guards and two watchers should therefore be urgently built at Pulathur.

(3) The forest guard of Kanavaipatti beat, now living at Ganguvarpatti, will hereafter be stationed at Tummalapatti, through which village sandalwood stolen from the Pulathur forests is understood to pass. A set of two rooms will be necessary at Tummalapatti to accommodate the forest guard and the watcher.

(4) Quarters for the subordinates of the Devadanapatti beat may be built at Devadanapatti, when funds permit.

852. *Cumbum Range.*—(1) A set of four rooms should be built at Tammannagoundanpatti for the beat subordinates of Kumli and Kappuvamadai beats.

(2) Another set of four rooms is necessary at Vannathiparai, to accommodate two forest guards and two watchers.

(3) A rest house, with out-houses, is essential at Arisiparai on the Surulipatti plateau, to enable the work in the teak plantations to be supervised efficiently. It will also help considerably to reduce the illicit fellings for which this plateau has been long notorious. Type II-B of the Forest Engineer is recommended, as a temporary shed here is likely to be burnt down.

(4) Buildings required for lac operations have been prescribed under Chapter IX.

853. *Palni Range.*—(1) The Kudiraiyar block supports a good type of pole forest and is the best bamboo area in the division. The locality is difficult of inspection for want of halting places at a reasonable distance from it. A temporary inspection shed, with out-houses, is therefore proposed at Periathorai (2,160 feet) on the Kudiraiyar river in the Kudiraiyar block. Type I-A of the Forest Engineer, communicated in his C. No. 195 of 1935, dated 11th May 1935, may be found suitable. An elephant trench round the sheds is essential to prevent damage from wild elephants which frequent this locality.

854. *Wells.*—The well at Pachalur is subject to much insanitary attention from the villagers and requires to be protected by a stout unscalable fence round it, or a wall, at a distance of some 50 feet all round. Without this provision the water is bound to be fouled.

855. Wells for subordinates' lines are required at Sirugudi (Natham range), Puthur, Malapatti and Kadapichampatti (Aiyalur range) and Subbalapuram (Sholavandan range).

856. A well at Chembanuthu, Pillayarnatham Fuel series, Aiyalur range, is necessary to improve watering facilities for grazing cattle.

857. The well in the Reserve Forest near Alangagowndanpatti (Aiyalur range) may be improved in collaboration with the District Board, as it serves the villagers also.

858. *Latrines.*—Borehole latrines are recommended for the forest rest-houses at Aiyalur, Kanavaipatti, Sengurichi, Kalpattichatram, Vemburli, Munnur, Kalluthu, Rajadhani, Rajagopalampatti, Virupakshi, Marianshola, Vandaruvu, Poombarai and Devadanapatti. Arrangements for this purpose are nil at present in most of the rest-houses. The other rest-houses are visited less frequently and temporary arrangements will suffice.

859. A statement showing the prescribed buildings and the order in which they may be taken up for construction is given below :—

Statement showing the list of buildings prescribed for construction and improvement in the Madura division, in the order of urgency.

Serial number and range.	Locality.	Name of building.	Type.	Estimated cost.	Remarks.
				RS.	
1 Sholavandan ..	Kalluthu	Subordinates' lines ..	Two rooms ..	1,380	
2 Do. ..	Theppathupatti ..	Do. ..	Do. ..	1,380	
3 Do. ..	Palamedu	Rest-house	Roof renewal and construction of garage.	750	
4 Do. ..	Kalluthu, Rajadhani and Rajagopalampatti.	Latrines to rest-houses.	Borehole	180	Rs. 60 each.
1 Natham	Natham	Latrine to range quarters.	..	100	
2 Do.	Manakattur	Subordinates' lines ..	Two rooms ..	1,210	
3 Do.	Velayudampatti ..	Do. ..	Do.	1,210	
4 Do.	Lingavadi	Do. ..	Do. ..	1,210	
5 Do.	Kanavaipatti, Vemburuli, Munnur and Sengurichi.	Latrines to rest-houses.	Borehole	240	Rs. 60 each as for item 4, Sholavandan range.

Statement showing the list of buildings prescribed for construction and improvement in the Madura division, in the order of urgency—cont.

Serial number and range.	Locality.	Name of building.	Type.	Estimated cost.	Remarks.
				RS.	
1 Aiyalur	Pillayarnatham ..	Rest-house	Repairs	300	Overhauling roof timber.
2 Do.	Aiyalur	Subordinates' lines ..	Do.	300	
3 Do.	Kadapichampatti ..	Do. ..	Two rooms ..	1,300	
4 Do.	Sekkanam	Do. ..	Do. ..	1,240	
5 Do.	Puthanatham ..	Do. ..	Do. ..	1,240	
6 Do.	Manaparai	Do. ..	Remodelling ..	75	
7 Do.	Kalpattichatram ..	Do. ..	Do. ..	150	
8 Do.	Kadapichampatti ..	Rest-house	II-B Type	2,000	II-B type of Forest Engineer's suggested.
9 Do.	Aiyalur and Kalpattichatram.	Latrines to rest-houses.	Borehole	120	Rs. 60 each as for item 4 of Sholavandan range.
1 Kodaikanal ..	Pulathur	Subordinates' lines ..	Four rooms ..	2,900	Corrugated iron roof.
2 Do. ..	Thummalapatti ..	Do. ..	Two rooms ..	1,260	
3 Do. ..	Kodaikanal	Do. ..	Do.	1,260	Corrugated iron roof.
4 Do. ..	Mariansliola, Vandaruvu, Poombarai and Devadanapatti.	Latrines to rest-houses.	Borehole	240	Rs. 60 each, as for item 4 of Sholavandan range.
5. Do. ..	Kodaikanal ..	Kitchen to clerk's quarters.	....	240	
1 Cumbum	Vannathiparai ..	Quarters for Paliyans.	Sixty rooms ..	3,000	As prescribed by Mr. Hafiz. One line of 30 rooms to be built in 1936–37 and another of 30 rooms in 1937–38.
2 Do.	Cumbum	Extension to lac godown.	100′ × 15′ ..	1,000	
3 Do.	Do.	Workshed	..	1,000	
4 Do.	Suruli-Arisiparai ..	Rest-house	II-B type	2,000	Urgent.
5 Do.	Vannathiparai ..	Subordinates' lines ..	Four rooms ..	2,020	For two beats.
6 Do.	Thammannagowndanpatti.	Do.	Do. ..	2,025	Do.
1 Palni	Kudiraiyar-Periyathorai.	Inspection shed ..	Type I-A	600	Type I-A of Forest Engineer's recommended. Shed Rs. 375. Out-house Rs. 125. Elephant trench Rs. 100. Total Rs. 600.
2 Do.	Virupakshi	Latrine to rest-house.	Borehole	60	As for item 4 of Sholavandan range.
			Total ..	32,330	

860. The following buildings are suggested :—

Serial number and range.	Locality.	Name of building.	Type.	Estimated cost.
				RS.
1 Sholavandan	Mettupatti	Subordinates' lines ..	Two rooms ..	1,260
2 Do.	Valayapatti	Do. ..	Do. ..	1,380
3 Do.	Malayur	Do. ..	Do. ..	1,625
4 Natham	Sathambadi	Do. ..	Do. ..	1,2[illegible]
5 Do.	Kasampatti	Do. ..	Do. ..	1,26[illegible]
6 Do.	Mulayur	Do. ..	Do. ..	1,210
7 Aiyalur	Pusaripatti	Do. ..	Do. ..	1,300
8 Do.	Thogamalai	Do. ..	Do. ..	1,240
9 Kodaikanal	Devadanapatti	Do. ..	Do. ..	1,260
10 Palni	Pachalur	Do. ..	Do. ..	1,700
11 Do.	Periyur	Do. ..	Do. ..	1,700
			Total ..	16,845

861. List of wells prescribed and suggested in the Madura Forest Division :—

Serial number and range.	Locality and nature of work.	Estimated cost.	Remarks.
		RS.	
1 Palni	Pachalur well : construct fence or compound wall.	100	Construction of fence or wall round well—absolutely necessary.
2 Natham	Sirugudi	250	New wells suggested.
3 Do.	Malaipatti	300	
4 Do.	Puthur	300	
5 Aiyalur	Kadapichampatti	300	
6 Do.	Chembanuthu, Pillayarnatham North series.	250	Prescribed for grazing cattle.
7 Do.	Alangagowndanpatti, Pillayarnatham Reserved Forest.	250	Suggested in collaboration with District Board. Total estimated cost Rs. 500.
8 Sholavandan	Subbalapuram	100	New well suggested.
	Total ..	1,850	

SECTION 10.—LEASES FOR CARDAMOM CULTIVATION.

862. The existing leases for the cultivation of cardamoms have been arranged in Appendix V in tabular form, in the order in which the leases are due to expire. Notice of expiry as due under the muchilika, should be served on the lessees by registered post, in proper time. Unless there have been serious complaints against any particular lessee,

the leases may be renewed for a further period of 25 years, at the current rates of assessment, in the case of those inside reserved forests. In the case of leases in unreserves they will be dealt with by the Revenue department as they expire.

863. Areas in reserved forests suitable for cardamom cultivation have been marked on the working plan map : a statement of the approximate extent of such areas is given below :—

Statement of areas fit for cardamom cultivation in the various reserves of Madura Forest Division.

Serial number and name of reserve and locality.	Number of bits.	Approximate area in acres.	Total approximate area in each reserve, in acres.	Remarks.
		KODAIKANAL RANGE.		
1 *Swamikanal*—				
Thandavankanal ..	3	5	..	
Swamikanal	1	68	..	
Vannathikadukanal ..	10	60	133	
2 *Pambar*—				
To the west of Tirugakalmottai.	1	12	..	
Below and above Pambar river between peaks 5,531′ and 4,123′.	3	22	34	
3 *Amburuvi*—				
South-east of Periakuni and north-east of Pathurmedu.	1	58	..	
East of Pathurmedu ..	1	2	..	
Between peaks 3,236′ and 4,812′.	1	6	..	
North of Masanankad ..	1	6	..	
North of Chokiankad ..	1	14	86	
4 *Shengalvariar*—				
Immediately to the west of peak 4,584′.	1	64	..	
To the north-east of peak 5,302′.	2	18	..	
To the north-east of peak 4,095′.	1	10	..	
To the south of peak 4,095′.	3	49	..	
To the south of peak 5,526′.	1	3	..	
To the north of peak 3,236′.	1	1	145	
		Total ..	398	
		CUMBUM RANGE.		
1 *Kombai*—				
To the north of Kottamalai leases.	1	30	30	
2 *Vannathiparai*—				
Medagaranmettu—				
(*a*) either side of stream	1	35	..	
(*b*) east of stream ..	1	15	50	(*b*) South of peak 3,189′ and north of peak 3,796′ on the Travancore boundary.
3 *Kuttanachiar*	2	250	250	Out of this five bits of an aggregate area of 211 acres have been surveyed and are kept ready for sale.
4. Melagudalur	1	8	8	
		Total ..	~~330~~ 338	
		PALNI RANGE.		
1 *Mulayar*	1	5	5	Close to the present lease in the reserve along the stream banks.
2 *Vennilai*	1	250	..	Main block all round patta lands of Vennilai.
	2	*20	270	* About half a mile towards north-east of Shambamalai.
3 *Northern Slopes*	1	30	..	North of Bothamalai patta lands.
	2	20	..	North of Nachiarkadu on both sides of the stream.
	3	50	..	South of I Kombu patta land up to reserved forest boundary on both sides of the stream.
	4	60	160	To the east of Pallathkalvai path close to reserved forest boundary.
4 *Siruvathukadu*	2	30	30	Below the top reserve boundary on either side of path leading to Kilakkuchetti path.

***Statement of areas fit for cardamom cultivation in the various reserves of Madura Forest Division.*—cont.**

Serial number and name of reserve and locality.	Number of bits.	Approximate area in acres.	Total approximate area in each reserve, in acres.	Remarks.
		PALNI RANGE—cont.		
5 *Kanienkadu*	8	200	..	To the north of Kanienkadu odai including old surveyed areas for Sikandir Ravuttar.
	3	20	220	To the east of Parappalar near existing leases.
6 *Kodavanar*	1	20	20	All along the southern bank of Kodavanar stream.
7 *Kokkuparai*	2	20	20	One bit a little to the north of lease No. 39 and the other to the south of the peak Vauthumarian.
8 *Pambukallar*	1	20	20	At the southern end of lease No. 15 below peak Satyamalai.
9 *Unjalnachi*	1	8	8	Adjoining Marudanadiar in the eastern end of Unjalnachi Reserved Forest.
		Total ..	753	
		Grand total ..	~~1,481~~ 1489	

864. The District Forest Officer will advertise these areas in the District Gazette every year and auction such of those for which demand arises in the manner that obtains now and lease them out as usual.

865. It has been mentioned in Chapter V of Part I, paragraph 232, that so far as shola forests are concerned the cardamom planter has been the most successful system of insurance against fire we have had and one that yields an income of Rs. 5 per acre per annum. Since these evergreen forests are not otherwise directly remunerative, leases for cardamoms therein should receive considerable encouragement. Examples of restoration of grass land into sholas by fire protection and planting have been mentioned in paragraph 232 of Part I. Lessees should therefore be encouraged to take up for cardamom cultivation localities adjoining sholas which have regressed into grassland or deciduous forests as a result of annual fires. A nominal assessment for the first six years, gradually raised to the usual level in the next four years, may afford the required inducement. If this proves successful our sholas will expand gradually at no cost to us and will ultimately bring in more revenue, and at the same time help to protect the existing sholas from fire.

SECTION 11.—SANDALWOOD AND TIMBER TRANSIT RULES.

866. The rules to regulate the transit of sandalwood within the Madura forest division came into effect from 1st June 1934. Under these rules several checking stations have been prescribed under Schedule B at which sandalwood in transit should be produced for check. The forests round about Pulathur (Lower Palnis) contain a larger proportion of sandal than any other area in the division, and there is reason to suspect that the wood is stolen from that locality. A checking station at Nilakottai will control any sandal moving from this area towards Madura or Kodaikanal road railway station, and thus help to check this theft. The Taluk office at Nilakottai may therefore be added to the list of checking stations under Schedule B.

867. It has been mentioned under Chapter V of Part I, paragraph 361, that the existing Timber Transit Rules have had a salutary effect in considerably reducing illicit removals of firewood in *cart-loads* from unreserves situated within the scheduled area. It is however unfortunate that the scheduled area excludes the Nilakottai taluk and that part of the Tirumangalam taluk which lies to the north of the Madura-Theni road. The protection of Andipatti and Vikramangalam reserves can be better secured if the tract described above is included in Schedule A and, in addition, the unreserves of this locality will receive more efficient protection. Protection in this locality is unsatisfactory at present. It is therefore recommended that steps may be taken to include the whole of the Nilakottai taluk and that portion of the Tirumangalam taluk which lies to the north of the Madura-Theni road, within Schedule A of the Timber Transit Rules for the Madura district.

SECTION 12.—STORES, TOOLS AND PLANT.

868. Saws, mamties and pickaxes will be required for the departmental timber operations prescribed for the Cumbum range, the teak plantations and the rab-sowings. An amount of Rs. 250 a year is provided for this purpose.

869. A length of 1,000 feet of wirerope half an inch in diameter, together with the necessary tightening gear, should be kept in each of the Sholavandan, Ayyalur and Natham ranges for hiring out to fuel contractors for use in fuel extraction—*vide* paragraph 552 (7) of Chapter IV of this Working Plan. The hiring charges for a year may be fixed at about a fifth of the cost of the rope and one-tenth of the value of the tightening gear, five and ten years being the respective periods of life estimated for them. An amount of Rs. 1,500 is provided for the period of the plan for six sets of ropes and three sets of tightening gear. The contractors can easily make the required number of pulleys for themselves.

870. A sum of Rs. 500 may be necessary for plant and equipment for crushing and washing lac.

871. Including a further sum of Rs. 1,500 for other unforeseen stores, an amount of Rs. 6,000 has been provided for the next ten years.

SECTION 13.—REDISTRIBUTION OF BEATS.

872. The following redistribution of beats is recommended in the interest of better protection :—

(1) *Sholavandan range.*—The northern slopes of Andipatti South reserve up to cairn No. 127, situated on the saddle between hill 1,547′ and the unreserve hill 1,472′, may be transferred from the Andipatti South beat to the Andipatti North beat.

The headquarters of the Moruthu beat may be transferred to Theppathupatti in order to enable the subordinates to control the illicit removals towards Kullapuram.

(2) *Ayyalur range.*—Sekkanam, Kalpatti and Pudukotta beats may be redistributed so that the Sekkanam beat may consist of Mogavanur and Semmalai I reserves and a part of Semmalai II ; Kalpatti beat of part of Semmalai II, Sigamkaradu, Methalamalai, Pakkirkaradu and Minnakaradu, and Pudukotta beat of Sorupam and Panjanthangi Hill and Panjanthangi Valley reserves.

(3) *Kodaikanal range.*—Consequent on the transfer of Manjampatti and other reserves to South Coimbatore, the Kukkal and Kavunji beats will require redistribution. The Kanavoipatti beat subordinates now living at Ganguvarpatti may be stationed at Tummalapatti to enable them to exercise more effective control over the transit of stolen sandal from the Pulathur forests.

SECTION 14.—MATCHWOOD.

873. Samples of *Melia dubia* timber were made into matchsplints at a match factory at Palghat and the splints were " dipped " and put into boxes at the Central Match Factory at Coimbatore. The splints do not break off on striking and they burn steadily and slowly. But a slight crackling is heard when burning, there is some smoke and the glow does not die out when the flame is extinguished. White sticks burn more readily than red ones and their appearance is preferred.

874. The factory at Palghat did not consider the wood suitable for veneers for boxes, but was of opinion that the white splints could be easily marketed. The red splints, in the writer's opinion, can also be sold as easily.

The matches are by no means of the best quality but worse matches are being offered for sale in the bazaar and apparently find a good market.

875. The large number of match factories in the Ramnad, Madura and Salem districts usually get their splints and veneers from factories on the West Coast. The veneers are made into boxes and the splints are treated and dipped in their factories. If the match factories at Dindigul and Madura, in the Madura district, and those in the neighbouring district of Ramnad are made aware of the large quantities of *Melia dubia* available in the Vannathiparai Valley and of its suitability for splints, it is possible that some of them will set up the required machinery for the manufacture of splints at Cumbum or some other neighbouring place. If successful, a considerable revenue will be obtained from the Cumbum range by the sale of *Melia dubia* for match splints.

876. On a close enquiry the view has been expressed that a small factory using second rate wood like *Melia dubia* is not likely to work at a profit so long as the excise duty on matches continues to prevail.

SECTION 15.—CONTROL.

877. Sample forms for the prescribed control records will be found in Appendix VI.

878. The maintenance of the control records prescribed for each working circle should receive the personal attention of the District Forest Officer. Copies of the control records relating to the previous year shall be submitted to the Conservator of Forests of the Circle every year by the 15th of May.

879. The following records are common to all working circles : each of them may be maintained in one bound book, but separate entries will be made for each working circle :—

(1) *Register of Deviations.*—All deviations from the prescriptions of this working plan, the necessity for each item of deviation and the authority sanctioning them, will be entered in this register, which will be maintained at the District Forest Office.

(2) *Control Journal.*—The District Forest Officer shall personally maintain a journal for each working circle giving a detailed account of its management. It should be in the form of a running commentary on all aspects of administration but with special reference to the prescriptions of this working plan and the extent to which they have been found suitable. Suggestions for modifying and improving existing practice should be freely made which will help the officer revising the plan.

The headings prescribed in Appendix VIII of the Forest Code may be taken as a guide and expanded suitably for each working circle. A sample form for the Fuel Working Circle is given in Appendix VI (*b*) on which control journals for other working circles may be based. Additional headings may be added at the discretion of the District Forest Officer, when necessary.

(3) *Annual Summary of Revenue and Expenditure.*—The Annual Summary of Revenue and Expenditure for the whole division should be maintained in the form given in Appendix VI.

880. *Control Maps and Fire Maps.*—Control maps have been prescribed for the Fuel Working Circle in which the boundaries of coupes as laid out, the areas actually felled, arrears, and the years of actual felling should be shown distinctly.

A set of *Fire maps* will continue to be maintained on cloth tracings of Survey of India maps (4″ = 1 mile) in which the estimated extent of each fire will be marked every year distinctively. One set of tracings may be made to serve for a period of five years.

SECTION 16.—MALARIAL PROPHYLAXIS.

881. At the instance of the Forest Utilization Officer, Madras, a malarial survey of the Vannathiparai Valley was carried out in January 1935 by the Malaria Officer, Madras, with a view to reduce the incidence of malaria on staff and labour employed on lac operations at Vannathiparai.

882. The Vannathiparai Valley is perhaps the most virulently malarious spot in the Madura division and the conclusions arrived at by the Malaria Officer should prove very useful in locating future accommodation for labour and staff in this area. His conclusions may be summed up as follows :—

(1) The cleared site in front of the Vannathiparai rest-house is not suited for the location of living quarters by reason of its proximity to streams which breed the dangerous mosquitoes, *Anopheles minimus* and *Anopheles fluviatilis*.

(2) The cost of tackling these breeding grounds is estimated at about Rs. 500 to Rs. 750 per annum, but any slackness in treating breeding grounds is likely to lead to intense sickness in camp.

(3) Where the streams widen out to about 5 or 6 yards of water surface the dangerous Anophelines mentioned above cease to breed and are replaced by *Anopheles barbirostris*, a species which is not an effective vector of the malarial parasite. But these sites are too far away to be useful.

(4) The effective range of flight of mosquitoes is usually about half a mile, so that this distance from heavy breeding grounds may be deemed to afford reasonable protection from malaria. Such a suitable site has been indicated on the map, where quarters may be built for housing staff and labour provided water from deep-bore wells could be secured.

(5) If, however, this is considered too far off or if water cannot be had there, a site nearer to the rest-house may be selected on the opposite side of the stream which has to be crossed before reaching the rest-house and not less than two furlongs from it. If this is done the stream referred to above will have to be permanently laid underground by means of roughstone subsoil drainage for a length of about one mile. This would cost about Rs. 4,000.

(6) In any case, methods of personal prophylaxis should be inculcated and a "kerosene parade" every evening is recommended.

CHAPTER XII.—ESTABLISHMENT AND LABOUR.

SECTION 1.—ESTABLISHMENT.

883. A considerable expansion in the activities of the division is inevitable with the introduction of this working plan. The number of Fuel Felling Series has been increased from 73 to 86; the exploitation of timber has been provided for by the formation of two series under a Selection Working Circle and of four series under a Clearfelling Working Circle; the tending and regeneration of sandal have been properly organised; and lac cultivation has been prescribed on an extensive scale. The artificial regeneration of fuel coupes on an extensive scale by "rab" sowings will involve a considerable amount of work on the protective staff, as well as the "gap" regeneration in the Selection Working Circle and the teak plantations. New roads and buildings will also involve additional work. The formation of about 6½ miles of *Acacia* belts round sholas every year has to be carried out. An increase of establishment will, therefore, be necessary in order to cope efficiently with the work involved.

884. *Administrative staff.*—The division consists of six ranges and there is a great deal of office routine, in addition to inspection of important works, such as regeneration, tending and lac cultivation. It is highly essential therefore that the District Forest Officer should always have the assistance of an experienced gazetted officer. This should be provided for as far as possible.

885. *Executive establishment.*—All operations connected with lac cultivation are of a highly technical nature and have to be carried out in proper time so as to ensure a successful crop. It is therefore necessary to have a responsible officer in charge of this work who is not liable to frequent transfers. It is prescribed that a ranger of active habits should be placed in charge of the Vannathiparai lac operations, under the supervision of the Range Officer, Cumbum. When lac work is slack, this ranger will have other works in the range to look after.

886. *Protective establishment*—(1) *Foresters.*—The number of fuel felling series in the Ayyalur range has been increased from 16 to 21. The reserves in the range are much scattered and there is a long mileage of roads to repair or construct, in addition to the extra work involved in inspecting rab regeneration and laying out coupes. The number of foresters in this range has to be increased from three to four to cope efficiently with the extra work involved.

A forester is required to work under the ranger in charge of the lac operations at Vannathiparai.

The present sanctioned strength of 19 foresters will thus have to be increased to 21.

(2) *Forest Guards.*—The sanctioned strength of forest guards is 88, after deducting one post transferred to South Coimbatore along with the area transferred thereto. The number of beats in the division is 84, each beat being in charge of a forest guard and a watcher. One guard will be required for the Surulipatti plantations and the gap regeneration on the Surulipatti plateau, and another for the Kumli and Vannathiparai plantations and the gap regeneration in the rest of the area. The remaining two will be required for exploitation work under the Selection Working Circle.

"Rab" regeneration work will bear most heavily on beat subordinates and it sometimes happens that in this connection two or three coupes will have to be attended to by the subordinates of one beat. This cannot be done efficiently without help. The number of fuel series in the Sholavandan, Natham and Ayyalur ranges is 18, 24 and 21 respectively. It is proposed that each of these ranges should be given two forest guards to help those beat subordinates who have a large number of coupes for "rab" regeneration. When this work is slack the guards should be usefully employed on patrolling reserves where illicit fellings are common or on exploitation work under the Selection Working Circle in the Cumbum range. The sanctioned number of forest guards should therefore be increased from 88 to 94.

(3) *Watchers.*—The sanctioned strength of watchers is 87. Three watchers will be required for lac operations. The total strength will thus require to be raised to 90. It is recommended that the watchers for lac operations may be selected from among the Paliyans settled at Vannathiparai as it will help to keep the settlers contented.

887. *Office establishment.*—The clerical work in the District Forest Office is very heavy and the present staff is unable to cope with the work efficiently and promptly. There is no doubt that the introduction of this Working Plan will add considerably to this work. In particular the preparation of coupe plans and the checking of coupe surveys are likely to be beyond the capacity of a solitary draftsman.

One more clerk will be necessary, at the least, to enable the office to cope with the work efficiently and it will be a great advantage if he be qualified to assist the draftsman.

SECTION 2.—LABOUR.

888. Scarcity of suitable labour has been a great handicap since the inception of lac experiments at Vannathiparai. For the same reason, expansion of lac cultivation to the maximum could not be prescribed in the present scheme. Without adequate labour many trees will remain unproductive, for years, awaiting their turn to produce a crop. This is most uneconomic, more particularly at the present time, when there is good demand and prices are improving.

889. As Paliyans are the only people who can do the pruning, infection, etc., on the big Kusum trees, they should be recruited in their villages and settled at Vannathiparai. Houses should be built for them and land for cultivation should be given free of assessment to serve as inducements to them to settle permanently in our forests. Employment of two or three suitable men as watchers will also be advisable and should help to keep the settlers contented.

890. There are now ten families in the settlement. Their number should be doubled, and if possible trebled, in 1935, and increased to fifty by 1938, if the operations are to expand on the prescribed lines.

891. When work on lac operations is slack the Paliyans may be usefully employed in collecting minor forest produce for the department, provision for which has been made under the Working Plan for the Minor Forest Produce Working Circle.

CHAPTER XIII.—FINANCIAL FORECAST AND COST OF THE WORKING PLAN.

SECTION 1.—FINANCIAL FORECAST.

892. Statements showing details of the estimated revenue and expenditure for the ten year period 1936–37 to 1945–46 are appended ; an abstract is given below :—

Details.	Revenue.	Expenditure.
	RS.	RS.
1 Selection Working Circle	5,80,250	3,60,050
2 Clearfelling Working Circle	33,400	13,547
3 Fuel Working Circle	10,60,257	51,000
4 Brakepole Working Circle	938	30
5 Bamboo Working Circle	40,000	140
6 Minor Forest Produce Working Circle	4,86,526	4,450
7 Lac Working Circle	3,41,000	1,92,502
8 Sandalwood Working Circle	..	575
9 Miscellaneous	9,44,435 (Grazing, unreserves, etc.).	1,78,270 (Roads, buildings, fire protection, etc.).
10 Establishment	..	10,85,580
Total	34,86,806	18,86,144

Total Revenue	34,86,806
Total Expenditure	18,86,144
Anticipated total surplus	16,00,662
Anticipated annual surplus	1,60,066 or 1,60,000

893. The financial results of the division are governed largely by the prices offered for the fuel coupes of Sholavandan, Natham and Aiyalur ranges. The average of prices realised in each range for the last six years have been used in these calculations, but these averages are higher than the prices obtained in 1933–34 though considerably lower than those in the previous quinquennium. Owing to a variety of reasons discussed elsewhere in this working plan there has been an unprecedented slump in the Madura fuel market from the year 1933, incommensurate with the fall in the general price level. There cannot but be an improvement in the future in the prices offered for fuel coupes.

894. The financial forecast shows a net annual surplus of Rs. 1,60,000 against the average annual surplus of Rs. 58,485 for the past 19 years, taking the average prices offered for fuel coupes for the last six years. On the phenomenally low prices realised in the years 1934—1936 the annual surplus anticipated will still be Rs. 1,10,320. Therefore with the general improvement in prices which can be justifiably expected in the future, the annual surplus is very likely to be still more favourable.

895. The gross revenue is Re. 0–13–4·6 per acre, and the expenditure is Re. 0–7–4·2 per acre, so that the surplus is Re. 0–6–0·4 per acre. The expenditure is 55 per cent of the gross revenue.

Financial Forecast.

I. Revenue.

Serial number and particulars.	Details.	Quantity, if any.	Rate.	Per	Reference to paragraphs of Working Plan.	Forecasted revenue or expenditure.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			RS. A. P.			RS.	
			I. SELECTION WORKING CIRCLE.				
1 By sale of timber.	Cumbum range (15,500 trees of 30 cubic feet each).	465,000 c.ft. ..	1 4 0	C.ft. ..	417 and 425 (ii).	5,71,250	Gross revenue anticipated. The forecast is for 9 years only.
2 By sale of aini trees	Natham range ..	90 trees	100 0 0	Tree ..	425 (ii) ..	9,000	
			II. CLEARFELLING WORKING CIRCLE.				
3 By sale of timber.	Velancombai, 1,870 plantations.	6,000 c.ft ..	1 4 0	C.ft. ..	494 ..	10,000	Yield calculated from average height growth of the different girth classes.
	Vannathiparai, 1,870 plantation.	6,400 c.ft. ..	1 4 0	C.ft. ..	494 ..	7,500	Do.
4 By sale of annual coupes.	(*a*) Surulipatti series.	100 acres ..	100 0 0	Acre. ..	460 ..	10,000	
	(*b*) Kumli series ..	50 acres	40 0 0	Do. ..	2,000	461	The Vannathiparai area has no saleable growth.
	(*c*) Velancombai series	40 acres	20 0 0	Do. ..	462 ..	800	
	(*d*) Iruttar series ..	20 acres ..	25 0 0	Do. ..	463 ..	500	
5 By sale of poles obtained from thinnings.	In all series	130 acres.. ..	20 0 0	Do. ..	..	2,600	Anticipated yield 400 poles per acre.
			III. FUEL WORKING CIRCLE.				
6 By sale of coupes— (*a*) Sholavandan.	17 Commercial series.	11,653 acres ..	12 1 0	Acre ..	..	1,39,964	Average per acre based on past 6 years' prices ending with 1934–35.
	1 Kumri series ..	300 acres.. ..	2 0 0	Do. ..	..	600	
(*b*) Natham ..	23 Commercial series.	15,418 acres ..	20 10 0	Do. ..	..	3,17,996	Average per acre based on past 6 years' prices ending with 1934–35.
	1 Kumri series ..	403 acres.. ..	2 0 0	Do. ..	..	806	
(c) Aiyalur ..	20 Commercial series.	16,195 acres ..	31 5 0	Do. ..	..	5,05,231	Average per acre based on past 5 years' prices.
	1 Reserve series ..	220 acres.. ..	6 0 0	Do. ..	..	1,320	
	2 coupes, Amayapuram series.	251 acres.. ..	2 0 0	Do. ..	..	502	
(*d*) Cumbum ..	6 series (5 commercial and 1 reserve).	3,792 acres ..	11 10 6	Do. ..	..	44,200	Average per acre based on past 6 year's prices.
(*e*) Kodaikanal.	8 Commercial series.	3,688 acres ..	8 14 0	Do. ..	..	32,131	Do.
	2 Eucalyptus series ..	41 acres	150 0 0	Do. ..	..	6,150	Revenue for 5 coupes in each series has been forecasted.
	1 Wattle series (deadwood for 2 years).	..	..	..	..	100	Lump sum.
	1 Wattle series. 3 coupes).	5·77 acres ..	20 0 0	Do. ..	..	115	Only sale of 3 coupes forecasted.
(*f*) Palni ..	2 Commercial series ..	1,537 acres ..	6 4 0	Do. ..	..	9,606	Average per acre based on past 3 years' prices ending with 1934–35.
	4 Reserve series. (5 coupes each).	512 acres ..	3 0 0	Do. ..	..	1,536	
			IV. BRAKEPOLE WORKING CIRCLE.				
7 By sale of brakepoles	Kodaikanal range ..	10,000 poles ..	0 1 6	Pole ..	124 ..	938	
			V. BAMBOO WORKING CIRCLE.				
8 By sale of coup	8 series for 10 years ..	..	4,000 0 0	Year ..	..	40,000	Based on past actuals and improved communications prescribed.

Financial Forecast—*cont.*

I. Revenue—cont.

Serial number and particulars.	Details.	Quantity, if any.	Rate.	Per	Reference to paragraphs of Working Plan.	Forecasted revenue or expenditure.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			RS. A. P.			RS.	
			VI. MINOR FOREST PRODUCE WORKING CIRCLE.				
9 By lease of Minor Forest Produce avaram bark, etc.	(*a*) In all six ranges except item (*b*) below.	....	..	..	..	1,97,500	Based on past actuals.
10 By sale of Minor Forest Produce.	(*b*) Collected in eastern half of Cumbum range.	10 years	800 0 0	Year. ..	665 ..	8,000	Departmental collection and sale.
11 By sale of coupes	2 acres each for *Eriodendron* planting.	20 acres	20 0 0	Acre ..	667 ..	400	
12 By sale of Kapok.	From *Eriodendron* plantation. †	5 years	50 0 0	Year ..	682 ..	250	
13 Cardamom leases.	Rentals from existing leases.	....	..	..	..	2,49,126	Kodaikanal, Palni and Cumbum ranges.
	Rentals from lands still available.	350 acres.. ..	2 8 0 to 5 0 0	Acre ..	863 ..	26,000	
	Royalty on new leases.	350 acres ..	15 0 0	Do. ..	863 ..	5,250	Past actual average is Rs. 22 per acre.
			VII. LAC WORKING CIRCLE.				
14 By sale of lac ..	Departmental collection.	13,640 maunds.	25 0 0	Maund ..	898 ..	3,41,000	At rates estimated by Mr. Hafiz.
			VIII. MISCELLANEOUS.				
15 Grazing	Sale of permits in all six ranges.	....	..	..	..	2,60,000	Increase of grazing fees in Kodaikanal range taken into consideration.
	Penning in Cumbum range.	1,700 cattle ..	5 0 0	100 ..	826 ..	850	
	Additional sale of permits for extra cattle (penned).	1,600 cattle ..	0 12 0	Each ..	826 ..	12,000	
16 By sale of thinnings.	Kodaikanal pine plantations.	10 years ..	100 0 0	Year ..	836 ..	1,000	
17 Other sources ..	(*a*) Confiscated forest produce.	....	..	..	..	5,383	Based on past actuals of 8 years ending with 1934–35.
	(*b*) Fines and forfeitures.	....	..	..	..	9,977	Do.
	(*c*) Rents on departmental buildings.	....	..	..	..	22,974	Do.
	(*d*) Compounding fees in forest offences.	....	..	..	..	87,650	Do.
	(*e*) Other items ..	....	..	..	..	1,47,800	Do.
18 Revenue—Unreserves.	Revenue Department figures.	....	..	..	..	3,60,301	Do.
19 Road maintenance.	District Board contribution.	....	..	..	..	36,500	Based on average of 3 years ending with 1935–36.
					Total ..	34,86,806	

II. Expenditure.

Serial number and particulars.	Details.	Quantity, if any.	Rate.	Per	Reference to paragraphs of Working Plan.	Forecasted revenue or expenditure.	Remarks.
			I. SELECTION WORKING CIRCLE.				
1 Cost of marking and tending.	In 2 series	10 years ..	100 0 0	Year ..	428 ..	1,000	
2 Cost of production.	(*a*) Logs (1/3 total yield).	15,500 c.ft. ..	0 6 0	C.ft. ..	..	58,125	
	(*b*) Sawn scantlings (2/3 total yield).	310,000 c.ft. ..	0 15 0	C.ft.	..	3,00,625	
3 Gap regeneration..	In all 4 series ..	60 gaps per year.	1 0 0	Gap. ..	433 ..	300	Forecast for 5 years only.
			II. CLEARFELLING WORKING CICRLE.				
4 Cost of production.	Fellings from two 1,870 teak plantations.	12,000 c.ft. ..	0 6 0	c.ft. ..	494 ..	4,500	
5 Cost of formation.	(*a*) Iruttar irrigated teak planting.	18 acres ..	69 0 0	Acre ..	459 ..	1,242	
	(*b*) Unirrigated teak planting (3 series).	171 acres ..	31 0 0	Do. ..	460 to 462.	5,301	
	(*c*) Kumri regeneration.	45 acres ..	18 0 0	Do. ..	490 ..	810	Part of Vannathiparai and Suranganar.
	(*d*) Thinnings and cleanings.	117 acres ..	2 0 0	Do. ..	488 and 489.	234	One thinning and one cleaning only.
	(*e*) Experimental planting in Suruli plateau.	8 acres ..	45 0 0	Do. ..	491 ..	360	
6 Cost of wire fencing	Vannathiparai 15 acre teak plantation.	1,600 yards ..	..	..	493 ..	500	
7 Trenching ..	Vannathiparai teak plantation, 1920–22.	80 chains ..	..	..	480 ..	600	
			III. FUEL WORKING CIRCLE.				
8 Cost of demarcation of coupes.	In 80 series of the division every year.	800 coupes ..	15 0 0	Coupe ..	541 ..	12,000	Based on past actuals.
9 Cost of rab regeneration in fuel coupes.	Half area of 76 coupes each year.	26,000 acres ..	1 8 0	Acre ..	560 ..	39,000	
			IV. BRAKEPOLE WORKING CIRCLE.				
10 Cost of gap regeneration.	10 gaps each year for 3 years.	30 gaps	1 0 0	Gap ..	596 ..	30	May be done free by subordinates.
			V. BAMBOO WORKING CIRCLE.				
11 Cost of experimental planting.	In 4 localities ..	20 acres ..	7 0 0	Acre ..	630 ..	140	
			VI. SANDALWOOD WORKING CIRCLE.				
2 Cost of tending sandal.	In 6 series	9,133 acres ..	0 1 0	Acre ..	647 ..	575	Provision is for 3 1/3 rotation.
			VII. MINOR FOREST PRODUCE WORKING CIRCLE.				
13 Cost of forming *Eriodendron* plantation.	2 acres per year ..	18 acres ..	25 0 0	Acre ..	683 ..	450	
14 Cost of departmental Minor Forest Produce collection.	Cumbum range ..	10 years ..	400 0 0	Year ..	665 ..	4,000	

FINANCIAL FORECAST—*cont.*

II Expenditure—cont.

Serial number and particulars.	Details.	Quantity, if any.	Rate.	Per.	Reference to paragraphs of Working Plan.	Forecasted Expenditure.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			RS. A. P.			RS.	
			VIII. LAC WORKING CIRCLE.				
15 Cost of production.	Cleaned lac	13,640 maunds ..	..	..	898	1,89,462	At rates estimated by Mr. Hafiz.
16 Cost of plantations prescribed.	(*a*) Planting ..	..	..		750	3,000	
	(*b*) Root suckers ..				751	40	
17 Cost of pruning *Shorea* trees.	Karandamalai ..	1,000 trees ..	4 0 0	100 trees.	766		
			IX. MISCELLANEOUS.				
18 Cost of permanent demarcation.	In 9 reserves	..	..	..	770	575	Five per cent interest on capital outlay of Rs. 2,300, for five years.
19 Maintenance of common zamin boundaries.	....	2 × 61½ miles ..	12 0 0	Mile ..	780 and Appendix II.	780	Two clearings estimated. Half recovery from zamindars.
20 Cost of fire protection.	(*a*) Sholavandan range.	44½ miles ..	4 0 0	Do. ..	785, 786.	1,780	Only early burning.
	(*b*) Natham range: Early burning.	17 miles	4 0 0	Do. ..	787, 788.	680	
	Refund of grazing fees.	Rs. 140 per year.	..	..	789 ..	1,400	
	(*c*) Palni range ..	44½ miles ..	4 0 0	Do. ..	791, 792 ..	1,780	Only early burning.
	(*d*) Aiyalur range ..	6 miles	4 0 0	Do. ..	794 ..	240	Do.
	(*e*) Cumbum range: Early burning.	26¼ miles ..	4 0 0	Do. ..	796, 799 ..	1,050	Rights of way and common boundary.
	Kumli ghat road: Fire tracing.	4 miles	10 0 0	Do. ..	..	400	
	Suruli plateau: Fire lines.	11 miles	20 0 0	Do. ..	798, 800 ..	2,200	
	Suruli plateau: Fire patrols.	2 for 4 months ..	10 0 0	Month ..	796 (7) ..	800	
	Sandal area: Fire lines.	3 miles	12 0 0	Mile ..	650 ..	360	
	(*f*) Kodaikanal range—						
	Early burning—foot-paths.	9 miles	4 0 0	Do. ..	803 ..	360	
	Law's ghat road—fire line.	14 miles	9 0 0	Do. ..	801 ..	1,260	
	Cooly ghat road—fire line.	4 miles	10 0 0	Do. ..	802 ..	400	
	Upper Palni sholas and pine plantations.	128 miles ..	1,232 0 0	Year ..	804 ..	12,320	Includes pay of 6 fire patrols for 5 months.
	Formation of wattle belts.	64 miles	70 0 0	Mile ..	806, 807 ..	4,480	Based on actuals—vide paragraph 293.
21 Cost of thinnings ..	In Kodaikanal pine plantations.	192 acres ..	5 0 0	Acre ..	836 ..	960	Work in half the area forecasted for ten years.
22 Maintenance of roads and paths.	In all six ranges ..	..	..	..	837 ..	1,01,850	Based on actuals of 5 years ending with 1933–34.
23 Improvements and new constructions.	In all six ranges— (*a*) Prescribed ..	..	..	..	844 (1 to 5).	1,350	Interest at 5 per cent on capital of rupees 5,400 for 5 years.
	(*b*) Suggested ..	..	..	..	845 (1 and 2).	800	Interest at 5 per cent on capital of rupees 3,200.
24 Maintenance charges for existing buildings and wells.	In all six ranges ..	..	..	..	846 ..	23,680	Based on actuals of 5 years ending with 1933–34.
25 Cost of new buildings	In all six ranges— (*a*) Prescribed ..	..	..	..	859 ..	8,094	Interest at 5 per cent on capital of rupees 32,375 for 5 years.
	(*b*) Suggested ..	..	..	..	860 ..	4,211	Interest at 5 per cent on capital of rupees 16,845.
26 Cost of new wells.	In all six ranges— Prescribed and suggested.	..	..	..	861 ..	460	Interest at 5 per cent on capital of rupees 1,850.
27 Cost of stores, tools and plant.	For all six ranges ..	..	..	..	870 to 873.	6,000	
			X. ESTABLISHMENT.				
28 Pay of officers ..	One Imperial and one Provincial.	..	..	..	..	1,85,280	Based on average pay.
29 Pay of establishment.	(*a*) Rangers—7 (includes 1 for lac).	..	..	..	..	1,15,920	Do.
	(*b*) Foresters—21 ..	..	..	..	..	93,240	Do.
	(*c*) Forest guards—94.	..	..	..	..	1,81,740	Do.
	(*d*) Reserve watchers—90.	..	..	..	..	1,08,000	Do.
	(*e*) Ministerial staff ..	..	..	..	..	88,800	Do.
	(*f*) Temporary staff.	..	..	..	..	5,000	Do.
	(*g*) Inferior service (peons).	..	..	..	..	15,840	Do.
30 Direction	Conservator and establishment.	..	..	..	..	1,23,760	One-fifth of actuals of 3 years' average.
31 Travelling allowances.	Whole division ..	..	..	..	..	85,000	Based on past actuals.
32 Fixed travelling allowances.	Do.	..	..	..	..	20,000	Based on present proposals.
33 Other compensatory allowances.	Do.	..	..	..	..	27,000	Do.
34 Contingencies ..	Do.	..	..	..	..	36,000	Based on average past 5 years.
					Total ..	**18,86,144**	

Financial Forecast: Lac.

896. The financial forecasts of the lac operations prescribed during the five years, 1935—40, are given below in two statements. In the first statement the yield of stick lac per tree and the average price per maund of washed lac are based on the actuals of 1934, whilst in the second statement a more conservative estimate of them is made.

STATEMENT I.

Revenue.

Yield of stick lac from 6,990 trees at 250 lb. per tree. (Paragraph 383) ..	17,47,500 lb.		
Yield of washed lac at 2·5 : 1 ratio. (Paragraph 385)	6,99,000 lb. or 8,524 maunds.		
	RS.	A.	P.
Revenue by sale of 8,524 maunds at Rs. 30 per maund	2,55,720	0	0
Expenditure.			
Cost of production of 8,524 maunds at Rs. 7–11–0 per maund at Cumbum. (Paragraphs 388 and 389)	65,528	4	0
Cost of packing and transport to Calcutta of 7,524 maunds at Rs. 7 per maund. (Paragraph 390)	52,668	0	0
Cost of packing and transport on 1,000 maunds to Madras at Rs. 1–9–0 per maund. (Paragraph 390)	1,562	8	0
Cost of establishment for 5 years at Rs. 2,500 a year. (Paragraph 764) ..	12,500	0	0
Cost of buildings, etc., one-fifth of total cost. (Paragraph 763)	1,460	0	0
Cost of plantations, etc.	1,500	0	0
Total Expenditure ..	1,35,218	12	0
Profit ..	1,20,501	4	0
	or		
	1,20,000	0	0
	approximately.		

STATEMENT II.

Revenue.

Yield of stick lac from 6,990 trees at 200 lb. per tree	13,98,000 lb.		
Yield of washed lac at 2·5 : 1 ratio. (Paragraph 385)	5,59,200 ,, or 6,819 42/82 or 6,820 maunds.		
	RS.	A.	P.
Revenue by sale of 6,820 maunds at Rs. 25 per maund	1,70,500	0	0
Expenditure.			
Cost of production of 6,820 maunds at Rs. 7–11–0 per maund at Cumbum. (Paragraphs 388 and 389)	52,428	12	0
Cost of packing and transport to Calcutta of 5,820 maunds at Rs. 7 per maund. (Paragraph 390)	40,740	0	0
Cost of packing and transport of 1,000 maunds to Madras at Rs. 1–9–0 per maund. (Paragraph 390)	1,562	8	0
Establishment for 5 years at Rs. 2,500 a year. (Paragraph 764)	12,500	0	0
Buildings, etc., one-fifth cost. (Paragraph 763)	1,460	0	0
Cost of plantations, etc. (Paragraphs 750 and 751)	1,500	0	0
Total ..	1,10,191	4	0
Profit ..	60,308	12	0
	or		
	60,000	0	0
	approximately.		

SECTION 2.—THE COST OF THE PLAN.

897. The total cost of the Working plan is Rs. 62,380. If liquidated during the period of the plan, an amount of about Rs. 6,200 has to be debited against the annual revenue: but the utility of the plan will extend beyond the ten year period as nothing more than minor adjustments are expected to be necessary at the next revision.

898. The cost of the plan per acre of the reserved forests dealt with is **Re. 0–2–6.**

899. The details of expenditure incurred are given below :—

	RS.	A.	P.
Pay of Working Plan Officer	22,510	3	0
Pay of establishment	22,770	8	0
Travelling allowances	10,987	4	0
Other compensatory allowances	468	15	0
Contingencies	1,755	3	6
Supplies and services	11	2	0
Field work	2,476	5	9
Estimated cost of printing fuel coupe maps	650	6	9
Estimated cost of printing key map	750	0	0
Total ..	62,380	0	0

900. Statement of operations to be carried out every year in the different working circles, except Fuel, Bamboo, Lac and Protection Working Circles.

Year.	Clearfelling Working Circle.				Brakepole Working Circle.				Minor Forest Produce Working Circle.			
	Felling.	Regeneration.	Weedings.	Cleanings and thinnings.	Marking and felling.	Gap regeneration.	Weedings.	Tending.	Felling.	Regeneration.	Weedings.	Cleanings and thinnings.
	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.
1936–37 ..	I	..	..	..	IV	..	..	..	I	..	..	..
1937–38 ..	II	I	..	..	V	IV & V	..	..	II	I	..	..
1938–39 ..	III	II	I	..	VI	V	IV & V	..	III	II	I	..
1939–40 ..	IV	III	II	..	VII	VI	V	..	IV	III	II	..
1940–41 ..	V	IV	III	..	VIII	VII	VI	..	V	IV	III	..
1941–42 ..	VI	V	IV	I	IX	VIII	VII	..	VI	V	IV	I
1942–43 ..	VII	VI	V	II	X	IX	VIII	IV	VII	VI	V	II
1943–44 ..	VIII	VII	VI	III	XI	X	IX	V	VIII	VII	VI	III
1944–45 ..	IX	VIII	VII	IV	XII	XI	X	VI	IX	VIII	VII	IV
1945–46 ..	X	IX	VIII	V	XIII	XII	XI	VII	X	IX	VIII	V

SANDALWOOD WORKING CIRCLE.

Year.	Name of series.					
	Sholavandan.	Natham.	Cumbum.	Kodaikanal and Kumrakad.	Kodaikanal and Pulathur.	Palni.
	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.	COUPE.
1936–37 ..	I	I	I	I	I	I
1937–38 ..	II	..	..	II	II	II
1938–39 ..	III	..	..	III	III	..
1939–40 ..	I	I	I	I	I	I
1940–41 ..	II	..	..	II	II	II
1941–42 ..	III	..	..	III	III	..
1942–43 ..	I	I	I	I	I	I
1943–44 ..	II	..	..	II	II	II
1944–45 ..	III	..	..	III	III	..
1945–46 ..	I	I	I	I	I	I

SELECTION WORKING CIRCLE.

Year.	Name of series.	Marking cum tending.	Felling.	Gap regeneration including weeding.	Tending.
		COUPE.	COUPE.	COUPE.	COUPE.
1936–37	Cumbum	I ..	..	..	..
	Gudalur	I ..	..	..	..
	Natham	10 trees ..	10 trees ..	..	..
1937–38	Cumbum	II ..	I ..	I ..	..
	Gudalur	II ..	I ..	I ..	..
	Natham	10 trees ..	10 trees ..	10 gaps ..	..
1938–39	Cumbum	III ..	II ..	II ..	..
	Gudalur	III ..	II ..	II ..	..
	Natham	10 trees ..	10 trees ..	10 gaps ..	..
1939–40	Cumbum	IV ..	III ..	III ..	..
	Gudalur	IV ..	III ..	III ..	..
	Natham	10 trees ..	10 trees ..	10 gaps ..	..
1940–41	Cumbum	V ..	IV ..	IV ..	..
	Gudalur	V ..	IV ..	IV ..	..
	Natham	10 trees ..	10 trees ..	10 gaps ..	..

SELECTION WORKING CIRCLE—*cont.*

Year.	Name of series.	Marking cum tending.	Felling.	Gap regeneration including weeding.	Tending.
		COUPE.	COUPE.	COUPE.	COUPE.
1941–42	Cumbum	VI	V	V	I
	Gudalur	VI	V	V	I
	Natham	10 trees	10 trees	10 gaps	10 gaps.
1942–43	Cumbum	VII	VI	VI	II
	Gudalur	VII	VI	VI	II
	Natham	10 trees	10 trees	10 gaps	10 gaps.
1943–44	Cumbum	VIII	VII	VII	III
	Gudalur	VIII	VII	VII	III
	Natham	10 trees	10 trees	10 gaps	10 gaps.
1944–45	Cumbum	IX	VIII	VIII	IV
	Gudalur	IX	VIII	VIII	IV
	Natham	10 trees	10 trees	10 gaps	10 gaps.
1945–46	Cumbum	X	IX	IX	V
	Gudalur	X	IX	IX	V
	Natham	10 trees	10 trees	10 gaps	10 gaps.

CHAPTER XIV.—SUMMARY OF PRESCRIPTIONS.

PART I.—GENERAL FACTS AND PAST WORKING.

PARA.

1 *Area and distribution.*—The Madura Forest Division consists of the Revenue district of Madura and the Karur, Lalgudi, Trichinopoly and Kulittalai taluks of the Trichinopoly district. The total area of the reserved forests under departmental management in the division is 3,96,841 acres or 620·1 square miles, distributed over 128 reserves. The division consists of six ranges :—

Name of range.	Area of reserve forests in acres.
1 Sholavandan	54,261
2 Natham	67,837
3 Aiyalur	52,581
4 Cumbum	41,825
5 Palni	74,196
6 Kodaikanal	105,871

1 and 22

2. *Climate*—The average annual rainfall is about 30 inches in the plains and about 60 inches on the hills (Kodaikanal). The bulk of the precipitation is in the North East monsoon. Frost occurs on the hills, where wide variations of humidity occur. The plains are hot and dry .. .. 18 and 19

3 *The forest.*—The main types met with, in the order of importance, are—

(1) The fuel forests,
(2) The timber forests,
(3) The gallnut forests,
(4) The grassland type,
(5) The low level sholas, and
(6) The plantations.

Bamboos occur, as well as sandalwood of immature size .. 35 and 66

4 *Past management.*—The exploitation of firewood, mainly for the Madura market, has been considerably developed in the Sholavandan, Natham and Aiyalur ranges. Timber extraction has not been seriously undertaken, in spite of illicit fellings to meet legitimate demands. Bamboos and minor forest produce have been exploited through contractors on the lease system. Small teak plantations have been raised in two places (Vannathiparai and Velancombai) and *Eucalyptus globulus* and the pines have been grown to a considerable extent on the Upper Palnis. Lac has been successfully grown on *Schleichera* trees in the Vannathiparai valley .. .. .. 95, 97, 98, 100, 127, 128, 146, 154 and 90.

Natural regeneration, from seed or coppice, has been depended upon in bamboo and fuel areas to maintain the growing stock, without appreciable results : the bamboo has been heavily overworked, in places, and is consequently being exterminated. Attempts were made to regenerate the timber forests of the Cumbum range, both naturally and artificially, but the cost has been excessive and elephants have repeatedly damaged all planted teak. Experiments on the reduction of the number of coppice shoots on *Albizzia amara* stumps have not yielded conclusive results. Sandal propagation has met with some success. More recently, "rab" and "kumri" regeneration of fuel coupes have been successfully accomplished, and lac has been grown successfully on a commercial scale in the Vannathiparai valley .. .. 50, 68, 166, 167, 181, 193, 305, 307, 335, 342, 348 to 354 and 355 to 359.

PARA.

The division has been worked always at a profit, the average annual profit between 1916 and 1934 being Rs. 58,485 .. 374

PART II.—FUTURE MANAGEMENT.

5 *Objects of management.*—The main object in fuelforests is to provide for the highest annual sustained net outturn of firewood per acre, in perpetuity, without deterioration. The timber and bamboo forests will be managed so as to supply the legitimate demands of the neighbouring villages. The evergreen forests will be leased for cardamom cultivation without prejudice to their protective nature. Sandal will be tended, protected and propagated. And lac will be grown on a commercial scale. 393 to 398

6 *Methods of treatment.*—Firewood will be exploited under "Simple Coppice", on a rotation of 30 years, the felled coupes being regenerated by "rab" or "kumri". The timber forests will be worked under a "Selection" system, and under "Clearfelling" followed by planting. Brakepoles will be supplied under a "Groupe-selection System". Bamboos will be exploited on a felling cycle of three years. Sandal will be tended and propagation centres will be formed in suitable localities. The expliotation of minor produce will be regulated over large units, and the experimental planting of *Eriodendron anfractuosum* and the cultivation of lac on a commercial scale, will be undertaken .. .. 399 to 406

7 *Working Circles.*—There will be nine Working Circles :—

	ACRES.	PARA.
(1) The Selection Working Circle of	14,366	
(2) The Clearfelling Working Circle of	700	
(3) The Fuel Working Circle of	167,157	
(4) The Brakepole Working Circle of	700	
(5) The Bamboo Working Circle of	110,454	
(6) The Sandalwood Working Circle of ..	16,000	
(7) The Minor Forest Produce Working Circle of	396,841 excluding unreserves.	
(8) The Lac Working Circle of	2,900	
(9) The Protection Working Circle of	121,427·15	408

8 *Period of plan.*—The Working Plan will be in force from 1936–37 to 1945–46. The Regeneration methods prescribed will be reviewed after five years. TheLac Working Plan will be in force from to 1935 to 1940 only .. .. 410 and 411

SELECTION WORKING CIRCLE.

9 *Constitution.*—The Working Circle includes 14,246 acres in the Cumbum range and 120 acres in the Natham range, or a total of 14,366 acres 415

10 *Valuation.*—In the Natham range, all trees of *Artocarpus hirsuta* over one foot in girth and of *Bischofia javanica* and *Mangifera indica* over three feet, were enumerated. In the Cumbum range, sample plots were enumerated in different localities, amounting to 1·13 per cent of the area, on the basis of which the total growing stock was worked out .. .. 380, 381, 416 and 417

11 *Silvicultural system.*—The method of treatment will be "Selection felling" of saleable species over a minimum girth. Re-placement will be secured partly by gap regeneration, but mainly by clearfelling and concentrated regeneration 419

12 *Species.*—Teak, *Dalbergia latifolia*, *Pterocarpus marsupium* and any other saleable species will be exploited in the Cumbum range. *Artocarpus hirsuta* and *Mangifera indica* will be felled in the Natham range. The species for regeneration will be teak, *Dalbergia latifolia*, *Pterocarpus marsupium* and *Artocarpus hirsuta* 420

PARA.

13 *Felling series.*—The three felling series prescribed are the "Natham" (120 acres) "Cumbum" (6, 628 acres) and "Gudalur" (7,618 acres) series 421

14 *Exploitable size.*—The minimum exploitable size is 6 feet at breast height for the Cumbum and Gudalur series, for all species : and 8 feet at breast height for *Artocarpus hirsuta* in the Natham series. Only decaying mango trees will be felled 422

15 *Felling cycle.*—A felling cycle of ten years is prescribed for the Cumbum and Gudalur series : the cycle will be annual for the Natham series 424

16 *Yield.*—The yield will be regulated by area for the Cumbum and Gudalur series but the probable number of trees expected from each of the annual coupes have been furnished. About 700 trees will be the annual outturn from the Cumbum series and 1,000 trees from the Gudalur series. A maximum of ten trees of *Artocarpus hirsuta* will be removed every year from the Natham series 425

17 *Coupes.*—The annual coupes have been marked so as to be approximately equiproductive 426

18 *Agency of fellings.*—In the Cumbum and Gudalur series, the exploitation will be departmental and Kallar labour should be employed. Trees may be sold standing in the Natham series. 427 and 430

19 *Marking.*—Simple marking rules are prescribed .. .. .. 428 and 430

20 *Regeneration.*—Twenty-five gaps every year for the first five years in each of the Cumbum and Gudalur series will be regenerated artificially in selected localities. Restriction or expansion will then be decided by the Conservator on the results achieved. All gaps (10 a year) will be regenerated in the Natham series .. 432 and 433

21 *Species.*—Teak will be the only species to be introduced on the Suruli plateau. *Dalbergia latifolia* and *Pterocarpus marsupium* will be introduced in the Vannathiparai valley. Teak, *Dalbergia latifolia* and *Artocarpus hirsuta* will be raised in the Natham series 434

22 *Size of gaps.*—The minimum size of gap for regeneration is 400 square yards 435

23 *Burning and planting.*—Stump planting is prescribed after burning, at an espacement of 3′ × 3′, the proportion of teak being one half. Seeds of *Artocarpus* should also be dibbled .. .. .. 436 to 438

24 *Subsidiary regulations.*—Casualites will be replaced in the year of planting. Weeding should be done as required, lantana, elephant grass and thorny climbers being uprooted. The Provincial Silviculturist should be consulted periodically regarding gap regeneration. The cost is estimated at 4 annas to 8 annas per gap .. .. 439 and 440

25 *Grazing and fire-protection.*—The Surulipatti plateau is recommended for closure to all grazing : and all minor produce therefrom will be collected departmentally .. .. 441, 665 and 830

A system of exterior firelines has been prescribed 798

26 *Demarcation of coupes.*—Coupes have natural boundaries, in the main. Wooden signboards will exhibit the number of the coupe and the year of felling 442

27 *Control.*—A Control Book, Record of Works and Regeneration ledger have been prescribed for maintenance 443

Clearfelling Working Circle.

28 *Constitution.*—The total area of the Working Circle is about 700 acres of which about 480 acres are on the Surulipatti plateau. All areas suitable for teak planting have been included, with the exception of the major portion of the Vannathiparai valley reserved for lac cultivation. Trees felled under the "Selection Working Circle" will be partly replaced by concentrated regeneration under this Working Circle 444

		PARA.
29	*Felling series.*—Surulipatti, Kumli, Velancombai and Iruttar are the names of the four felling series prescribed. Their areas are 480, 120, 55·4 and 40 acres, respectively. Teak will be raised under irrigation in the Iruttar series	451 and 452
30	*Valuation.*—An area of 62·5 acres was enumerated on the Surulipatti plateau. Two quality classes have been distinguished and all areas have been marked on the management maps ..	454 and 455
31	*Silvicultural system.*—The silvicultural system will be "*Clear-felling*" followed by concentrated artificial regeneration ..	456
32	*Species.*—Teak will be the principal species to be planted. *Dalbergia latifolia* and *Pterocarpus marsupium* will be grown with teak	457
33	*Exploitable size and rotation.*—An average girth of 6 feet over bark at breast height will be aimed at. A rotation of seventy years has been adopted tentatively, primarily with a view to work out the annual plantable area	458
34	*Annual coupes.*—The areas of the annual coupes in the four series will be— ACRES. Surulipatti series .. .. 10 Kumli series .. .. 10 (5 acres near the Kumli ghat road and 5 acres in Vannathiparai valley). Velancombai series .. .. 4 Iruttar series 2	459 and 462
35	*Yield.*—The yield will be regulated by area. The tabular statement in para. 454 will give a rough idea of the outturn per acre.	463
36	*Fellings.*—The coupes will be sold in auction. The leases should terminate by the end of December	464
37	*Species for regeneration.*—Teak will be the primary species. *Dalbergia latifolia* and *Pterocarpus marsupium* will be raised as a mixture to the teak. Adventitious tree species will be retained as necessary	465
38	*Espacement.*—The teak will be planted 6′ × 6′ : the *Dalbergia* and *Pterocarpus* among the teak in quincunx, in *alternate* rows, in equal proportions	466
39	*Seeds.*—Local seed from good, straight grown trees is recommended. Detailed instructions are given in	468 and 469
40	*Nursery.*—Detailed instructions about nurseries are given. The Travancore method is prescribed. The cost of production of stumps is estimated at between Rs. 3 and Rs. 4 per 1,000 ..	470 to 479
41	*Preparation of site.*—A fireline should first be burnt round the planting area. Any growth and all undergrowth should then be cut and heaped. The first burning should be about the middle of February and piling and reburning completed by the middle of March	481
42	*Protection against game.*—The Vannathiparai failed teak plantations (1920–22) should be protected by an elephant trench all round it before the site is prepared for planting. A trench 6′ × 5′ × 3′ is prescribed, the excavated earth being thrown *inside*. Estimated cost Rs. 600	480
43	*Lining and staking.*—Stakes 2′—3′ long should be put in before 10th April at 6′ × 6′ for teak and in quincunx for the subsidiary species	482
44	*Bunds and water channels.*—For the Iruttar series, temporary bunds and a system of water channels should be constructed before lining and staking	483
45	*Planting.*—The planting of stumps in crowbar holes is described. Stumpplanting is prescribed in the middle of April, as an experimental measure	484

PARA.

46 *Casualties.*—Replacement of casualties should be done till the end of November of the year of planting. Ordinarily, no replacement may be done in the second year 485

47 *Weeding.*—Weeds should be removed by the cheapest method, soil aeration being of secondary importance. The first weeding should consist of uprooting weeds and elephant grass to a radius of 2 feet, the weeds in the intermediate strip being cut with a knife. Subsequent weedings may consist of mamti scraping, or other methods of removal, but consultation with the Provincial Silviculturist is emphasised. The eradication of lantana and bamboo should be aimed at. Natural regeneration and regrowth of tree species should not be cut back unless it is interfering with the major species, planted or natural 486

48 *Pruning and cutting back.*—Damaged seedlings should be promptly cut back. Multiple shoots should be reduced to one. Forked stems and stout sidebranches should be pruned flush with the stem. All these operations should be done during all weedings except the first 487

49 *Cleanings.*—Creeper cutting, removal of bamboos, lopping the branches of interfering adventitious species and assisting the development of the subsidiary species should be done from the third year onwards as required 488

50 *Thinning.*—Thinnings should be early, frequent and as heavy as they can be, without making a lasting break in the canopy. Big girth should be aimed at rather than height. The mixture of subsidiary and adventitious species will be regulated during thinnings. The first thinning may be necessary in the 4th, 5th or 6th year : the District Forest Officer will decide. The Provincial Silviculturist should be consulted periodically on the degree and frequency of thinnings 489

51 *Kumri regeneration.*—The coupes near the Kumli ghat road and in the area in the Vannathiparai valley protected by the proposed elephant trench may be regenerated in combination with the raising of agricultural crops. The necessary conditions have been prescribed 490

52 *Experimental.*—(1) One acre will be planted at 3′ × 3′ and another at $4\frac{1}{2}' \times 4\frac{1}{2}'$, every year for the first four years, in the Surulipatty series, with a view to the suppression of elephant grass. The results will be reviewed thereafter and future espacement decided upon 491

(2) The Irrigated teak will be grown in the Iruttar series, in which the comparative merits of percolation against flooding and irrigation on alternate days against once a week will be decided in consultation with the Provincial Silviculturist .. 492

53 *Vannathiparai 15 acre teak plot.*—The 15 acres teak plot in Vannathiparai planted from 1928 to 1930 will be protected against wild elephants by means of wire ropes, estimated to cost Rs. 500. It will then be thoroughly cleaned and all damaged teak cut back in 1937 (February-March). It will be cleaned again in 1938, if necessary.. 493

54 *Teak plantations of* 1870.—The Vannathiparai teak plantation of 1869–70 (3·4 acres) will be clearfelled departmentally in 1937–38 and the Velancombai plantation (1870) in 1936–37. If the stumps fail to coppice vigorously, the areas should be planted up. 494

55 *Fire protection.*—Open fire lines 20′ broad will protect the plantations all round, the intervening lines between plantations being limited to 10′ 495

56 *Inspection paths.*—In addition to firelines, a six foot strip running along the middle of the plantations, will be maintained as inspection path 496

57 *Demarcation.*—Stone pillars at corners will indicate the year of formation 497

58 *Cost of formation.*—The estimated cost of formation at the end of second year is Rs. 69 for irrigated teak, Rs. 31 for unirrigated teak and Rs. 18 for kumri regeneration 498

59 *Control.*—A Control Book, Record of Works, Nursery Ledger and Regeneration Ledger are prescribed 499

PARA.

The Fuel Working Circle.

60 *Constitution.*—The total area of the Fuel Working Circle is 1,67,157 acres, spread over all the six ranges 500

61 *Division of the area.*—The Working Circle has been divided into 86 felling series, of which 75 are commercial series, 9 are reserve series intended for doubtful local demand, and two are intended for regeneration by kumri, exclusively. Of these 18 are in the Sholavandan range, 24 in Natham range, 21 in Aiyalur range, 11 in Kodaikanal range and 6 in each of the Cumbum and Palni ranges .. .. 515 and 516

62 *Valuation and description of crop.*—Stockmaps showing the species and the estimated outturn of fuel in tons have been prepared. A description of each felling series is attached .. .. .. 518 and 519

63 *Method of treatment.*—The "Simple coppice" system is prescribed, but tamarind, sandal and *Terminalia chebula* shall not be felled except approved old or unsound tamarind trees. *Schleichera trijuga* will also be retained in the Suranganar and Vannathiparai felling series .. .. 520 and 521

64 *Rotation.*—A rotation of 30 years is adopted for all deciduous fuel series and *Eucalyptus globulus*. *Acacia decurrens* will be worked on a rotation of 10 years .. .. 522 and 533

65 *Interim rotation.*—Interim rotations varying from 25 to 35 years have been adopted in the transition stage where a felling series has been working on a different rotation 534

66 *Regulation of working.*—One coupe in each of the Commercial series will be felled every year: in the Reserve and Kumri series, one coupe will be felled every year if there be a reasonable offer, or demand for Kumri, respectively .. .. 536 to 538

67 *Deviation.*—Arrear coupes in Commercial series may not be carried forward for more than one year without the sanction of the Chief Conservator. For Reserve and Kumri series, no deviation is involved if coupes cannot be worked as allotted .. .. 539 and 540

68 *Survey.*—The coupes will be laid out on the ground, using the Working Plan maps as a *guide*. Slopes should be measured *horizontally* when surveying .. .. 541 and 542

69 *Strips.*—Every coupe will be divided into 4 strips 544

70 *Indicator area.*—Indicator areas need be felled only when the District Forest Officer deems them necessary; the lessees will fell them in current coupes 545

71 *Agency of fellings.*—Felling will generally be through contract agency. If the Kodaikanal municipality has to be supplied with Eucalyptus fuel for generating electricity, one series may have to be worked departmentally. Kumridars may fell "Kumri coupes" and Reserve series may be leased to panchayats .. 546 and 549

72 *Average outturn and cost of production.*—A statement showing the average outturn, cost of felling and transport to the market and the average price realized per acre for each of the felling series is furnished 550

73 *Arrear coupes.*—Procedure to deal with arrear coupes is detailed .. 551

74 *Felling and extraction rules.*—Rules are given in detail 552

75 *Artificial regeneration.*—Necessity for regeneration is discussed and rab and kumri regeneration prescribed. Rab regeneration will be undertaken over quarter of each coupe and extended to the whole if possible. No artificial regeneration is prescribed in Eucalyptus and wattle plantations .. .. 553, 559 and 573

76 *Rab regeneration.*—The first one strip of each coupe will be regenerated in the year of felling, with the onset of the North-east monsoon 560

PARA.

77 *Burning and soil preparation.*—The slash heaped up in broken lines will be burnt by subordinates and the ash well raked into the soil. Patches 2′ square and 6″ deep will be prepared in two parallel lines and 6′ apart in the lines .. .. 561 and 563

78 *Species.*—A list of species recommended is given. *Albizzia amara, Albizzia lebbek, Acacia ferruginea, Acacia planifrons, Melia indica* and *Chloroxylon swietenia* should be used in preference to others 565

79 *Sowing.*—Several species should be sown in each patch and sufficient seed should be used. No part of the area should be skipped. Dibbling should be done early in the north-east monsoon .. 566 and 569

80 *Casualties.*—Casualties will be replaced by sowings in the following south-west monsoon 570

81 *Quantity of seeds.*—Large quantities should be stocked, with the help of the Provincial Silviculturist if necessary 571

82 *Weeding and tending.*—Weeding of climbers and soil aerating after the last rains in January are prescribed for the first year : little else may be found necessary. A cleaning and tending may be necessary between 3rd and 5th year. The Provincial Silviculturist's advice may be sought 572

83 *Kumri regeneration.*—The merits of the method are described and it is prescribed that it will be applied to the whole area of the coupes in the Vellalapatti and Koilpatti kumri series. It may be extended to other series with sanction of the Chief Conservator. The procedure for kumri regeneration is laid down in detail .. .. 574 to 580

84 *Demarcation.*—It is prescribed that demarcation stones should *follow* fellings, and should refer to the area leased out. The number of a coupe should agree with the actual sequence of felling 581

85 *Local demand.*—The contractor shall meet the demand of the local ryots at the coupes, at rates fixed by the District Forest Officer. 582

86 *Statistics.*—The details of accounts to be furnished by the contractor are laid down 583

87 *Grazing.*—Fuel coupes shall normally be closed to grazing for ten years after felling. Closed and open areas should be differentiated suitably 584

88 *Fire protection.*—No special fire protection for fuel areas is prescribed, as fires are not common. Certain areas liable to fires will be protected under the methods prescribed for general fire protection in Chapter XI 585

89 *Climber poisoning.*—Experimental poisoning of thorny climbers is prescribed for a period of three years in the Sathiar, Anjukulipatty, Suranganar, Machakkal and Vannathiparai felling series. 586

90 *Control.*—A Control Book, Record of Works, Regeneration Ledger and a set of control maps are prescribed and a tabular statement of fellings appended .. .. 587 to 591

The Brakepole Working Circle.

91 *Constitution.*—The Working Circle extends over an area of about 700 acres along both sides of the Kodaikanal ghat road, between Tum-Tum-parai and Mulaiyar 595

92 *Silvicultural system.*—The method of treatment will be "Selection in groups" 596

93 *Felling cycle.*—A felling cycle of 20 years is adopted tentatively .. 597

94 *Coupes and yield.*—The annual coupes of 30–35 acres are estimated to yield about 1,000 brakepoles each 598

95 *Marking.*—The species to be marked for fellings and the rules for marking are detailed 600

		PARA.
96	*Felling and disposal.*—The felling should be departmental or under departmental supervision. Coppice regrowth should be aimed at. Disposal of brakepoles through a commission agent is recommended	601 and 602
97	*Regeneration.*—The artificial regeneration by rab sowings, of ten gaps a year, for three years, is prescribed experimentally. The Conservator will then review the results obtained and decide future treatment	603
98	*Species.*—*Albizzia amara, Dalbergia latifolia, Pterocarpus marsupium* and *Shorea talura* will be used in rab sowings	604
99	*Soil preparation.*—Slash should be carefully burnt in the centre of gaps in April. Patches $1\frac{1}{2}' \times 1\frac{1}{2}' \times 6''$ should then be prepared at an espacement of $6' \times 6'$ and staked	605
100	*Dibbling.*—The patches will be dibbled in June, in the south-west monsoon, one species per patch. Half the patches will be dibbled deep	606
101	*Planting.*—Stumps of *Dalbergia* and *Pterocarpus* should also be tried	607
102	*Casualties.*—Casualties will be replaced in September-October ..	608
103	*Weeding.*—Weeding and tending will be done by the subordinates, as required. The Provincial Silviculturist will be consulted ..	609
104	*Control.*—A Control Book, Record of Works and a Regeneration Ledger will be maintained	610

The Bamboo Working Circle.

105	*Constitution.*—The Working Circle includes all bamboo bearing areas in the division. Both *Bambusa* and *Dendrocalamus* occur. The total area of the Working Circle is 1,10,454 acres	611 to 617
106	*Valuation.*—All bamboo areas have been stockmapped by eye ..	619
107	*Silvicultural system.*—Bamboos will be exploited on a felling cycle of three years under carefully controlled rules	620 and 623
108	*Felling series.*—Eight felling series have been formed : the boundaries of each series have been described and net bamboo areas given	621 and 622
109	*Fellings.*—Each felling series is divided into three coupes, except the Natham series the whole of which will be felled once in three years. Gross and net bamboo areas of coupes are given ..	624
110	*Felling rules.*—Felling rules are detailed	625
111	*Agency and period of contract.*—The coupes will be leased out, the period of lease being normally one year. For the Kudiraiyar series, a three year lease is suggested for the three coupes, in order to encourge road construction	626 and 627
112	*Regeneration.*—Experimental planting of *Bambusa* and *Dendrocalamus* rhizomes is prescribed over one acre every year in each of four selected localities, for a period of five years	628 to 630
113	*Planting.*—Planting of 2—3 year old rhizomes in pits $2' \times 2' \times 1\frac{1}{2}'$ spaced $12' \times 12'$, is prescribed. The planting should be in the south-west monsoon if favourable : otherwise early in the north-east monsoon	630
114	*Protection from cattle.*—The plots should be effectively fenced ..	630
115	*Fire protection.*—No special protection against fires is prescribed.	631
116	*Statistics.*—The lessees shall render details of removals of different "classes" of bamboos, every month, to the District Forest Officer	632 and 633
117	*Control.*—The Control forms prescribed are the Control Book and the Record of Works. Strict and careful control of bamboo fellings is emphasised	634

PARA.

The Sandal Working Circle.

118 *Constitution.*—The Sandal Working Circle includes all sandal bearing areas in the division and all localities in which it is considered desirable to propagate it. The area covered by sandal is 2,740 acres, while the area of the Working Circle is 16,000 acres .. 635 to 642

119 *Valuation.*—The result of enumeration of all sandal in the division, conducted in 1929–31, is given. All sandal bearing areas were stockmapped by the Working Plans staff .. .. .. 644 and 645

120 *Method of treatment.*—Tending is the primary treatment prescribed. Any dead sandal met with during such tending will be exploited if it contain heartwood of the minimum diameter of a rupee .. 646

121 *Tending.*—Rules for tending are given in detail 647

122 *Tending cycle.*—The tending cycle will be three years 648

123 *Regulation of tending.*—A tabular statement exhibits the coupes to be tended and describes their boundaries 649

124 *Fire protection.*—The Vellaparai sandal area will be specially protected by cut lines, burnt to a width of 50′. The Karandamalai area will be protected by a special scheme detailed in Chapter XI. The sandal in the Kodaikanal and Palni ranges will receive no special protection. Propagation centres will be protected by scraped lines 10 feet wide .. .. 650 to 654

125 *Grazing.*—All sandal bearing areas will be closed to grazing .. 655

126 *Propagation centres.*—Detailed instructions are given about the formation of propagation centres. At least five centres shall be made every year in each of twenty-one given beats .. .. 656 to 658

127 *Control.*—The Record of Works and the Journal of Propagation-centres shall be maintained 659

The Minor Forest Produce Working Circle.

128 *Constitution.*—The Minor Forest Produce Working Circle covers the whole of the Madura Forest division—reserve and unreserve. The Revenue district of Madura and the Trichinopoly, Karur, Lalgudi and Kulittalai taluks of the Trichinopoly district are included. Areas under panchayats and certain other specified areas of small extent are excluded .. .. 660 to 662

129 *Division into units.*—Gallnuts, avaram bark and tamarind are of major importance and will each be sold separately. The gallnuts will be sold separately in each of three specified units, avaram bark in ten units, and tamarind in seven units. Other minor forest produce will be sold jointly or severally in seven units. The sale of *Buchanania latifolia* kernels is recommended .. 666

130 *Method of treatment.*—Exploitation will normally be through contractors except from the part of the Cumbum range lying east of the Kumli ghat road. All minor forest produce (except avaram bark) in the reserves of the Cumbum range lying east of the Kumli ghat road will be collected departmentally for the next three years through the Vannathiparai Paliyans. If departmental collection be found unsatisfactory the Conservator may order leases, except for Surulipatty plateau 665

131 *Period of lease.*—Gallnuts will be leased from July to June, avaram bark from April to March, tamarind from January to June. Other produce will normally be leased from July to June but the District Forest Officer may reduce the period in order to minimise fires 666

132 *Planting of Eriodendron anfractuosm.*—The experimental planting of *Eriodendron* for "Kapok" floss is prescribed and its silviculture discussed.. .. .. 667 to 669

133 *Area.*—About twenty acres have been selected in the Pandarathorai reserve of the Cumbum range, as suitable for planting. Two acres will be planted every year .. .. 670 and 671

PARA.

134 *Soil preparation.*—The site will be clearfelled and slash left over will be well burnt by the end of April. Pits $1\frac{1}{2}' \times 1\frac{1}{2}' \times 1'$ will be prepared in May at an espacement of $24' \times 24'$ 672

135 *Species.*– *Eriodendron*, the primary species, will be spaced $24' \times 24'$. *Dalbergia latifolia* will be planted at $6' \times 6'$ in the same lines, along with the *Eriodendron* 673

136 *Nursery.*– A nursery should be opened to provide 500 stumps of *Eriodendron* and 4,000 stumps of *Dalbergia* 674

137 *Planting.*– Two stumps of *Eriodendron* will be planted at each pit, 6′ apart. One stump of *Dalbergia* will be planted in a crowbar hole every 6′ along the lines 675

138 *Casualties.*– Casualties will be replaced in October 676

139 *Weeding.*– Two or three weedings in the first year and one or two in the next may be found necessary 677

140 *Cleanings.*—The cleaning should aim at leaving one healthy established *Eriodendron* in each pit 678

141 *Thinnings.*—The District Forest officer may thin among the *Dalbergia*, with the sanction of the Conservator 679

142 *Protection.*—Cattle must be kept out 680

143 *Demarcation.*—Plantations should be demarcated by engraved stone slabs at all four corners 681

144 *Exploitation.*—The " Kapok " should be farmed departmentally and correct accounts maintained 682

145 *Cost of formation.*—The cost of formation is estimated at a little over Rs. 25 per acre 683

146 *Control.*—The contractor shall furnish monthly accounts of collections of minor forest produce. A control Book will be maintained at the District Forest Office. A separate Control Book, Nursery Ledger, Regeneration Ledger and Record of Works will be maintained for the *Eriodendron* plantations .. 684 and 685

The Lac Working Circle.

147 *Constitution.*—The Working Circle comprises an area of 2,900 acres in the Vannathiparai valley of the Cumbum range in which gregarious patches occur of well grown *Schleichera trijuga* suitable for lac cultivation .. .. 686 to 689

148 *Valuation.*—Enumerations disclose the existence of 7,296 trees of *Schleichera* (kusum) out of which 1,278 are below two feet in girth. The 6,018 trees above 2 feet in girth will be used to grow lac .. .. 690 and 695

149 *Division of the area.*—The trees have been divided into four blocks, A, B, C and D. The trees in each block will produce a lac crop once in two years. Of the two years, 18 months will be spent in growing shoots and 6 months in producing lac 691

150 *Method of treatment.*—A detailed account of lac cultivation on *Schleichera* and of the life history of the lac insect is given in Appendix VIII .. .. Appendix VIII.

151 *Freeing and pruning.*—Host trees should first be freed from interfering trees of other species. The tree should then be pruned. Full details of the pruning operations are given including time and cost. First pruning may be dispensed with if labour is scarce .. .. 694 to 704

152 *Infection or Inoculation.*—Methods of inoculation (infection) are described .. .. 707 to 718

153 *Cropcutting.*—Directions are given for cropcutting 719

154 *Conversion and disposal.*—Full directions are given about the methods of conversion and disposal of the lac .. .. .. 720 to 745

PARA.

155 *Statement of operations.*—Initial pruning will normally be done in January-February and June-July, up to 500 trees being pruned each time. The intial pruning will be suspended in 1936 as Paliyan labour is insufficient 746

Up to April 1938, 500 trees will be pruned, infected or harvested in each of the two seasons, every year. From April 1938 to April 1940, 1,000 trees will be infected or harvested twice a year. 747

156 *Cleaning.*—Trees of other species interfering with host trees should be removed 748

157 *Pollarding.*—Twenty selected saplings of *Schleichera* should be topped experimentally in February in 1935, 1937 and 1939 to induce "Candelabra branching." 749

158 *Rootsuckers.*—Every year ten *Schleichera* trees should have their roots exposed and the exposed portions wounded in order to induce rootsuckers. Results should be noted 750

159 *Planting.*—An acre will be planted every year with kusum seedlings. The site will be cleared and slash burnt in March-April .. .. 751 and 752

160 *Pitting.*—Pits 2′ × 2′ × 2½′ will be dug at a triangular spacing of 15′ × 15′ or 20′ × 20′ and filled up 2 or 3 weeks before planting 753

161 *Seeds and nursery.*—Fresh and one year old seeds should be sown separately and results recorded : nursery practice is detailed .. 754 and 755

162 *Planting.*—Seedlings, stumps or seedlings in balls of earth may be planted out in the pits with the outbreak of the monsoon .. 756

163 *Watering and weeding.*—The seedlings should be watered and weeded as necessary. Ploughing up the area once a year is prescribed .. .. 757 and 758

163-A One acre will be regenerated annually with *Scheichera* by 'rab' sowings in the Vannathiparai vally .. .. . 758 A

164 *Numbering.*—Trees should be numbered serially as they are pruned, the number being painted on the stem as well as on a zinc plate nailed to the tree 759

165 *Weather record.*—Records of temperature and humidity should be maintained 760

166 *Control.*—" A Record of Lac operations "and " History of trees " will be maintained as described .. .. 761 and 762

167 *Buildings.*—Quarters for Paliyans, Extensions to Lac godown, work-shed, and plant for crushing and washing lac are prescribed at an estimated cost of Rs. 7,304 763

168 *Establishment.*—An assistant ranger, a forester and three watchers are prescribed. Frequent transfer of the Range Officer, Cumbum, and the assistant ranger is to be discouraged 764

169 *Labour.*—The Paliyan settlement at Vannathiparai should be expanded to 50 families by 1938 765

170 *Lac on Shorea talura.*—The introduction of lac on *Shorea talura* is proposed, as an experimental measure, on the Karandamalai plateau which is estimated to contain about 49,000 trees above two feet in girth. One thousand *Shorea* trees will be pruned in July–August 1936 and infected in December 1938 or June 1939. 766

171 *Fire protection.*—No special measures are considered necessary .. 767

The Protection Working Circle.

172 *Constitution.*—The area of the Protection Working Circle is 121,427 acres, out of the total area of reserved forests of 396,841 acres .. 768

173 *Treatment.*—Only grazing, collection of minor forest produce and cultivation of cardamoms will be permitted 769

Miscellaneous Prescriptions.

174 *Final demarcation.*—The final demarcation of nine reserves is prescribed 770

PARA.

175 *Disreservation.*—Deleted .. .. 771 to 773

176 *Boundaries of Reserves.*—Steps should be taken to renotify the boundaries of certain reserves so as to agree with the actual existing boundaries as soon as the amendments to the Madras Forest Act, now on the anvil, have been passed into law. Certain enclosures require demarcation or settlement. A list of discrepancies observed by the Working Plans party is given .. 774 to 777

177 *Boundaries common to zemindaries.*—A statement is furnished (Appendix II) of boundaries common to zemindaries which require clearing once in five years: most of the zemindars have agreed to share the cost .. .. 778 to 781

178 *Fire protection-General.*—Proposals for future fire protection are based on the following general lines:—

(*a*) For the Fuel Working Circle, there will be no special fire protection but boundaries common to zemindaries will be early burnt in December–January .. ..

(*b*) The deciduous forests above the Fuel Working Circle will be protected by firetracing rights of way, early burning of fire lines, and closure of certain areas to grazing or leasing of minor forest produce .. .. 782 to 784

(*c*) In the cases of incendiarism, areas will be closed to grazing as a silvicultural measure, with the sanction of the Collector, or the grazing fees may be enhanced temporarily .. .. ..

(*d*) The Upper Palni sholas and plantations will be ultimately fire protected by growing belts of wattle round them .. ..

179 *Fireprotection : Sholavandan Range.*—Common zemindari boundaries will be early burnt to a length of 34½ miles and certain footpaths will be early burnt to a length of 10 miles .. .. 785 to 786

180 *Fire protection : Natham Range.*—Fifteen miles of old firelines and some grassy patches in the Alagar hills will be early burnt and certain footpaths in other reserves. The Karandamalais will be protected, experimentally for 3 years in the first instance, by a scheme under which the hill villagers take up the responsibility for protection in return for a moiety of the grazing fees .. 787 to 790

181 *Fire protection : Palni Range.*—Certain frequented paths and the northern boundary of the Upper Palni unreserves will be early burnt .. .. 791 to 793

182 *Fire protection : Aiyalur Range.*—Common zemindari boundaries will be early burnt .. .. 794 and 795

183 *Fire protection : Cumbum Range.*—Certain rights of way will be early burnt. The Surulipatti plateau will be closed to grazing and protected by a fire line and minor forest produce on it will be collected departmentally : 16 miles of the Travancore frontier will be early burnt .. .. 796 to 800

The Kombai sandal area will be protected by a fire line .. ..

The teak plantations will also be protected by fire lines .. ..

184 *Fire protection : Kodaikanal Range.* The Law's ghat road and the Coolie ghat road will be firetraced to a width of 100 feet on either side for 14 miles and 4 miles 3 furlongs, respectively : certain specified footpaths will be early burnt .. .. .. 801 to 803

185 *Fire protection : Upper Palni sholas, Kodaikanal Range.*—The Upper Palni sholas will be fire protected for the present by *early burning* the surrounding grass land away from the scraped lines before the end of January 821

Future protection will be secured by growing a double belt of wattles round them, as fully described, at the rate of 6¼ miles a year over 12 miles .. .. 804 to 820

186 *Record of results of fire protection.*—Paintings and photographs of sholas have been made from specified localities in order to serve as standards for future comparison and conclusions 822

		PARA.
187	*Fire protection by coffee plantations.*—It is suggested that the sholas in Swamikanal Reserved Forest may be fireprotected by leasing out a belt of surrounding grassland for coffee cultivation	823
188	*Fire protection—Control.*—Fire maps have been prescribed ..	882
189	*Grazing.*—Goats shall be entirely excluded : all sandal areas will be closed to grazing : fuel coupes shall be closed to grazing for 10 years including the year of exploitation : no sheep shall be admitted into the reserves of Sholavandan, Natham and Aiyalur (except Kulitalai taluk) ranges	824
	The rates of grazing fee shall continue to be as they are, except that the low rates prevailing in the greater part of Kodaikanal range are recommended for enhancement to the general level	825
	Four pens are proposed to be opened in the Cumbum range to accommodate 1,700 head of cattle	826
	The Surulipatty plateau should be permanently closed to grazing ..	827 to 831
	Tanks, wells and springs intended for watering grazing cattle should be kept in good repair	832
	Fodder grass in headloads may be removed free from any part of a reserve, except from areas closed to grazing on account of fire damage	833
190	*Kodaikanal Pine plantations—Thinnings.*—The pine plantations should be thinned as soon as the existing dead pine have been disposed of. Statement showing area and order of thinnings is given	834 to 836
191	*Roads.*—All roads and buildings will be kept in good repair. Specified roads require widening in places	837 and 838
	A programme of road construction is given, prescribing certain new roads and suggesting others	839 to 845
192	*Buildings and Wells.*—All buildings will be kept in good repair. Latrines have been prescribed wherever urgent. A programme of building construction is given, prescribing certain new buildings and suggesting others	846 to 860
193	*Cardamom leases.*—A list showing dates of expiry of present leases is given and their renewal prescribed for a period of 25 years, at current rates. Leases in unreserves will be transferred to the Revenue department	862
	A statement is given of areas suitable for cardamom cultivation as marked on the management maps : leases may be granted for them	863 and 864
	Encouragement of leases	865
194	*Sandalwood and Timber Transit rules*—The establishment of a checking station for sandal at Nilakottai is suggested and the expansion of the area under the Timber Transit rules to include the whole of the Nilakottai and part of the Tirumangalam taluks.	866 and 867
195	*Stores, tools and plant.*—Three sets of wire ropes each 1,000 feet long, and the necessary tightening gear will be purchased and hired out to contractors of fuel coupes. Provision has been made for tools for departmental timber operations' regeneration work, plant for crushing lac. A total of Rs. 6,000 has been provided for 10 years	868 to 871
196	*Redistribution of beats.*—The redistribution of certain beats has been prescribed in the interest of better protection	872
197	*Matchwood.*—*Melia dubia*, occurring in the Cumbum range, has been found to be somewhat suitable for match splints, but is unlikely to be remunerative so long as the excise duty lasts ..	873 to 876
198	*Control.*—The control records should receive the District Forest Officer's personal attention. Copies of all control records should be submitted to the Conservator of Forests by the 15th of May, every year. The Register of Deviations, the Control Journal and the Annual Summary of Revenue and Expenditure will be	

PARA.

common to all Working Circles, but entries should be separate for each Working Circle. Sample headings are given for the Control Journal. Control maps are prescribed for the Fuel Working Circle and a set of fire maps should be maintained .. .. .. 877 to 880 and Appendix VI (a) to (o)

199 *Malarial prophylaxis.*—The conclusions of the Malaria Officer regarding malarial prophylaxis in the Vannathiparai valley are given .. .. 881 and 882

Establishment and Labour.

200 *Administrative.*—The District Forest Officer should always have an experienced gazetted assistant 883, 884

201 *Executive.*—A ranger of active habits should be in direct charge of lac operations, under the supervision of the Range Officer, Cumbum 885

202 *Protective.*—The number of Foresters should be increased from 19 to 21, of Forest Guards from 88 to 94, and of watchers from 87 to 90 886

203 *Office.*—One more clerk, preferably qualified to assist the draftsman, will be the minimum required at the District Forest Office .. 887

204 *Labour.*—The Paliyan settlement at Vannathiparai should be increased from 10 to 50 families by 1938 .. .. .. 888 to 891

Financial Forecast.

205 *Financial forecast.*—The anticipated average gross annual revenue is Rs. 3,48,680 and the average annual expenditure is Rs. 1,88,614 so that an average annual surplus of about Rs. 1,60,000 has been forecasted 892

206 *Forecast per acre.*—The anticipated gross revenue is 13 annas and 4·6 pies per acre, the expenditure 7 annas 4·2 pies per acre and the surplus 6 annas 0·4 pies per acre. The expenditure is 55 per cent of the gross revenue 895

207 *Cost of the plan.*—The Working Plan has cost Rs. 62,380. The cost per acre works out to 2 annas 6 pies .. .. 897 to 899

Check of Control Returns.

The following points require special attention when preparing and checking the control returns :—

208 *The Selection Working Circle.*—The number of trees felled may be checked against the number estimated. The employment of Kallar labour has been emphasised .. ..

The marking rules must be observed. The number and minimum size of gaps for regeneration, espacement (3′ × 3′) species (Teak, Rosewood, Vengai and Aini) and regeneration costs may be checked. The regulations about grazing, collection of minor forest produce and fire-protection should be observed 441

209 *The Clearfelling Working Circle,*—The leases should terminate by the end of December. Teak, Rosewood and Vengai are prescribed for regeneration. Espacement normally 6′ × 6′ but experimentally 3′ × 3′ and $4\frac{1}{2}'$ × $4\frac{1}{2}'$, each over an acre for 4 years. Subsidiary species in quincunx in alternate rows. Details about nursery practice given : cost of production of stumps is Rs. 3 to Rs. 4 per 1,000. Stamp planting in the middle of April is prescribed experimentally. .. ..

Casualties will be normally replaced only in the year of planting till end of November .. ..

Weeding will consist of uprooting, knife cutting and mamti scraping combined with eradication of lantana and bamboos : Provincial Silviculturist will be consulted. Adventitious tree species to be judiciously retained .. ..

PARA.

Multiple shoots should be reduced to one, damaged seedlings promptly cut back, and sidebranches pruned early 487

Cleanings will be done from the third year as required 488

Thinnings should be early, frequent and heavy and should aim at big girth. It may be executed in the 4th, 5th or 6th year as the District Forest Officer deems necessary. The Provincial Silviculturist should be consulted on the degree and frequency of thinning 489

Plantations should be formed by the "Kumri" method near Kumli ghat road and Vannathiparai if possible. Irrigated teak will be grown in the Iruttar series in which the comparative merits of percolation and flooding and the effects of frequency of irrigation will be studied 492

The 15 acre teak plot (1927–29) at Vannathiparai will be protected by wire ropes against elephants in 1936 and will be cleaned in February 1937 and if required in 1938 493

The 50 acre teak plot (1920–22) will be protected by an elephant trench all round before replanting 480

The 1870 teak plantations at Vannathiparai and Velancombai will be clearfelled departmentally in 1937–38 and 1936–37. They will be planted up if they fail to coppice vigorously 494

Open firelines 20 feet wide will protect the plantations all round and 10 feet wide between plantations 495

Demarcation will be by stone pillars 497

Cost of formation is estimated for each series 498

210 *The Fuel Working Circle.*—The system is "Simple Coppice" but tamarind sandal, and *Terminalia chebula* shall not be felled except approved trees and no *Schleichera trijuga* shall be felled in Suranganar and Vannathiparai series .. .. 520 and 521

In the commercial series, one coupe will be felled every year: arrear coupes may not be carried forward for more than one year without the sanction of the Chief Conservator .. .. .. 536 and 539

In the Reserve and Kumri series, one coupe will be felled every year if there be demand but no deviation is involved if coupes cannot be sold regularly .. .. 539 and 450

Every coupe will be divided into four strips 544

Fellings will normally be through contractors except if Kodaikanal Municipality wants fuel 546

Arrear coupes will be sold and felled next year along with next coupe 551

At least the first one strip will be regenerated by "rab" in the year of felling in the north-east monsoon, casualties being replaced in the next south-west monsoon. The Provincial Silviculturist should be consulted regarding tending .. .. .. 560 and 570

Kumri regeneration is prescribed for two series and recommended for others .. .. 574 and 580

Demarcation stones should bear numbers according to the actual sequence of fellings 581

Coupes will be closed to grazing for ten years 584

Closed areas should be differentiated suitably 584

Fire protection is by early burning zemindari boundaries and certain frequented paths 585

Climbers will be poisoned experimentally for three years in coupes of five series 586

The control map will show the actual coupe as leased out, the area felled and year of felling, and arrears with year of felling 591

211 *The Brakepole Working Circle.*—The system will be "Selection in groups" 596

Estimated yield is 1,000 poles 598

Marking rules are detailed 600

Disposal by commission agents recommended 602

Ten gaps per year should be regenerated artificially by rab sowings, as an experimental measure and future procedure decided .. 603 and 604

		PARA.
212	*The Bamboo Working Circle.*—There are eight felling series and the felling cycle is three years	621 to 624
	Coupe will be leased normally for one year but coupes in Kudiraiyar series may be leased out for three years together to encourage road construction. The Natham series of one coupe will be sold once in three years	626 and 627
	Bamboos will be planted (*Bambusa* and *Dendrocalamus*) experimentally for five years, one acre in each of four localities: protection from cattle imperative	628 to 630
	Strict and careful control of fellings emphasised	634
213	*The Sandal Working Circle.*—Tending is the treatment prescribed primarily, on a three year cycle: any dead tree with valuable heartwood will be exploited if found when tending	646 and 648
	Special fire protection of Vellaparai sandal area is prescribed: the Karandamalai sandal will be protected by a scheme of village co-operation	650 to 654
	All sandal bearing areas will be closed to grazing	655
	Detailed instructions are given about formation of propagation centres. At least five centres shall be made every year in each of 21 given beats	656 to 658
214	*The Minor Forest Produce Working Circle.*—Gallnuts will be leased in three units, avaram bark in ten units, tamarind in seven units. Other minor forest produce will be sold jointly or severally in seven units	666
	All minor forest produce in reserves of Cumbum range east of the Kumli ghat road will be collected departmentally by Paliyans for three years, experimentally	
	Surulipatty plateau will not be leased at any time	665
	Gallnuts will be leased from July to June, avaram bark from April to March, tamarind from January to June and others normally from July to June	666
	Eriodendron anfractuosum will be planted 24′ × 24′ over 2 acres every year. *Dalbergia latifolia* will be mixed with the *Eriodendron* at 6′ × 6′. Cattle must be kept out	667 to 680
	Demarcation will be by engraved stone slabs	681
	The "Kapok" will be farmed departmentally	682
215	*The Lac Working Circle.*—Initial pruning will normally be done in January–February and June-July, up to 500 trees being pruned each time. No initial pruning in 1936	746
	Up to April 1938, 500 trees will be pruned, infected or harvested twice a year. From April 1938 to April 1940, 1,000 trees will be treated similarly	747
	Trees interfering with hosts should be felled	748
	Experimental pollarding of 20 saplings and experimental production of rootsuckers from 10 trees, of *Schleichera*, prescribed ..	749 to 750
	One acre will be planted every year with *Schleichera*	751 to 758
	Record of weather conditions to be maintained	760
	Trees should be numbered and the "Record of Lac operations" and the "History of Trees" maintained.	759, 761 and 762
	One acre will be regenerared with *Scheichera* by rab savings, every year for three yeers	758-A
	1,000 *Shorea talura* trees on the Karandamalais will be pruned in July–August 1936 and infected experimentally in December 1938 or June 1939	766
216	*Protection Working Circle.*—Grazing, collection of minor forest produce and cultivation of cardamoms are permissible ..	769
217	*Miscellaneous Prescriptions.*—Final demarcation of nine reserves to be done	770
	Boundaries of reserves to be checked and renotified	774 to 777
	Common zamindari boundaries will be cleared over specified lengths once in five years, the cost being shared equally with zamindars	778 to 781

PARA.

General fire-protection will be secured by early burning certain paths and common boundaries .. .. 785 to 803

Karandamalais will be protected experimentally for three years, under a scheme of village co-operation .. .. 787 to 790

The Upper Palni sholas will be protected by early burning of surrounding grassland until the wattle belts proposed round them get effectively established .. ..

Six and a half miles of wattle belts will be formed every year .. 804 to 821

Fire maps will be maintained 882

Grazing rates for Kodaikanal range are recommended for enhancement 825

Four pens will be opened in Cumbum range 826

The Surulipatti plateau should be closed to grazing .. .. 827 to 831

Watering facilities for grazing cattle should be improved 832

Fodder grass may be removed free in headloads 833

The Kodaikanal pine plantations should be thinned as soon as possible .. .. 834 to 836

Some new roads and buildings are prescribed and others are suggested .. .. 846 to 860

Renewal of existing cardamom leases and granting of new leases recommended .. .. 862 to 864

Amendments to Sandalwood and Timber Transit Rules are proposed 866, 867

Wire ropes should be stored and hired out for extraction of fuel.. 868 to 871

Certain beats may be redistributed and their headquarters shifted. 872

Melia dubia may be found saleable for match splints .. .. 873 to 876

Sites at Vannathiparai for housing labour have been selected by the Malaria Officer 881, 882

218 *Establishment and Labour.*—An experienced gazetted assistant for the District Forest Officer and an extra clerk have been provided for 883, 887

A ranger should be in direct charge of the Vannathiparai lac operations 885

Foresters should be increased to 21, forest guards to 94 and watchers to 90 886

The Paliyan settlement at Vannathiparai should be increased to 50 families by 1938 891

219 *Financial forecast.*—An increase of annual surplus from Rs. 58,485 to Rs. 1,61,600 is forecast 892

APPENDICES.

The following are the Appendices to this plan :—

Appendix I.—Statement showing discrepancies observed in reserve boundaries.

Appendix II.—Statement showing the length of common zemin boundaries to be maintained.

Appendix III.—List of sholas in the Upper Palnis not under special fire protection.

Appendix IV.—List of photographs of Upper Palnis sholas taken in 1935 and of paintings made in 1918.

Appendix V.—Statement showing dates of expiry of cardamom leases.

Appendix VI (*a*) to Appendix VI (*o*).—Control forms —15.

Appendix VII (*a*) and Appendix VII (*b*).—Botanical and Vernacular indices of trees and shrubs found in Madura division.

Appendix VIII.—On lac insect and lac industry.

Appendix IX.—Maps—These include—

(1) Key maps, 1 sheet, 1″ = 1 mile.
(2) Management maps, 75 sheets per set, 4″ = 1 mile.
(3) Fuel coupe maps, 40 sheets per set, 4″ = 1 mile.

APPENDIX I.

Statement showing discrepancies observed in reserve boundaries between actuals, village maps and survey of India sheets.

Serial number and name of reserve. (1)	Name of village which it adjoins, where discrepancy is noticed. (2)	Position of discrepancy on map; cairn numbers and other locations. (3)	Corresponding cairns as numbered on the ground. (4)	Remarks. (5)
		KODAIKANAL RANGE.		
1 Murugamalai ..	Kamachipuram.	South—151–146.	151–146 ..	The boundary on the ground does not tally with the village map.
	Do.	145–142.	145–142 ..	The boundary on the ground differs from the village map from cairn No. 144. The boundary runs north for 26 chains and then north-east for 27 chains and then turns south joining up with cairn No. 142.
	Pudukottai ..	West—29–31 ..	29–31 ..	Between these cairns the boundary does not tally with the village map since the boundary is found to go right inside the reserve.
2 Swamikanal, Block XVIII.	..	West—49–2 ..	49–1 A ..	On the north-western side the boundary on the ground differs from the Survey of India sheet. On the ground the boundary is one straight line.
	Poombarai ..	East—24–26 ..	24–26 ..	Between these cairns the boundary is one straight line and does not pass through cairn No. 25 as marked in Survey of India sheet.
3 Amburuvi ..	Tenkarai ..	South-east—No numbers given in Survey of India sheet.	..	From a point on the left bank of Amburuvi river (the meeting point of coupes to be worked during 1939–40 and 1940–41) to the south-eastern point of Amburuvi reserve the boundary on the ground differs from the village map.
		SHOLAVANDAN RANGE.		
4 Sirumalai-Kachaikatti Block.	Thethur ..	South ..	..	On the south-eastern corner of the coupe to be worked during 1942–43, the boundary on the ground does not tally with the village sheet since there is an encroachment from the adjoining patta.
		CUMBUM RANGE.		
5 Suranganar ..	Melguadalur ..	6–8 ..	6–8 ..	The Vairavanar has eroded a portion of the land along which this boundary runs with the result 3 intermediate cairns are missing.
6 Kombai	Kombai ..	380–384 ..	380–384 ..	Slight variations due to not following the village survey stones, are found in three places. In the first case a small portion of the adjoining unreserve is found included in the reserve. Near cairns 382 and 384 the survey stones as per village map are not traceable and 1 to 2 cents of land now patta is to be included in the reserve.
		PALNI RANGE.		
7 Velancombai ..	Balasamudram ..	510–522 ..	..	The eastern outer boundary as per the village plan includes a portion of the existing reserve near the new teak plantation and in the village accounts the same is included in the adjoining patta.
		AYYALUR RANGE.		
8 Thopaswamimalai.	..	11–13 and 73–75.	134–132 and 74–75.	Exclusions made for temples between these cairns are not shown in the village map.
9 Panjanthangi ..	Ayyalur ..	570–572 ..	570–572 ..	An area of 2 acres handed over to burial ground is not shown.
10 Do. ..	Kombai ..	528–529 ..	528–529 ..	The line on the ground agrees with the Survey of India sheet but it differs from the village map.
11 Sundamalai ..	Ayyalur ..	38–40, 55–56, 64–65, 66–67 and 68–70.	..	Here the boundary agrees with the Survey of India sheet but it differs from the village map. In the southernmost portion of Sundamalai there is marked difference in the boundary as marked in the Survey of India sheet and the village map and actually what is found on the ground. In the maps the Sundamalai reserve is shown separate from the Shorimalai but actually on the ground they are contiguous.
12 Shorimalai ..	Puthur ..	236–238 ..	236–238 ..	Between these cairns there is a patta encroachment.
Kaluvadi hills ..	..	58–60 ..	243 A–242 A ..	As per the village map the boundary from cairn No. 58 instead of passing through No. 59 joins up at an intermediate cairn 2½ chains to the east of cairn No. 59, while on the ground the boundary from No. 58 passes through No. 59, then turns eastwards and extends for a length of 2½ chains and then proceeds to cairn No. 60.
		NATHAM RANGE.		
14 Erukalamalai and Perumalmalai.	Punnapatti ..	71–73 ..	259–261 ..	North-west corner of Papanmalai. } The boundary on the ground differs both from the village map and Survey of India sheet.
15 Do.	Sathambadi ..	81–84 ..	276–278 ..	North-east corner of Papanmalai. } The boundary on the ground differs both from the village map and Survey of India sheet.
16 Do.	Do. ..	109–110 ..	335–337 ..	An encroachment not found in the village map and Survey of India sheet is noticed.
		112–113 ..	340–341 ..	Differences are found between the boundary in the village map and the actual boundary on the ground.
		121–122 ..	406–407 ..	(do.)
		123–125 ..	420–422 ..	(do.)
		127–129 ..	433–435 ..	(do.)
		130–131 ..	438–440 ..	(do.)
17 Do.	Do. ..	137–138 ..	458–467 ..	The Survey of India sheet and the ground agree but these differ from village map.
Do.	Do. ..	143–146 ..	481–484, 489–490 and 494–496.	Boundary on the ground differs from the village map and Survey of India sheet.
Do.	Do. ..	180–185 ..	180–180 B, 180 B–182 A, 183–183 B and 184 A–185.	The boundary agrees with Survey of India sheet but differs from village map.

Statement showing discrepancies observed in reserve boundaries between actuals, village maps and survey of India sheets—cont.

Serial number and name of reserve. (1)	Name of village which it adjoins where discrepancy is noticed. (2)	Position of discrepancy on map; cairn numbers and other location. (3)	Corresponding cairns as numbered on the ground. (4)	Remarks. (5)
		NATHAM RANGE—*cont.*		
20 **Erukalamalai and Perumalmalai.**	Lingavadi	236–237	236–237	Boundary differs only from village map.
		238–241	238–238 A	Of these only between Nos. 244–245 the boundary on the ground agrees with Survey of India sheet while in the rest there is difference from both.
		244–245	241—243	
			255–256	
21 Do.	Do.	247–252	259–263	Up to cairn No. 250 of Survey of India sheet the boundary on the ground agrees with Survey of India sheet; only afterwards it differs.
			265–266	
			273–274	
		253–254	283–284	On the ground after cairn No. 291, the number 273 is given again and continued serially. Only in the last instance there is agreement with the Survey of India sheet while in all other places the boundary differs from both.
			286–288	
		296–298	290–291	
			299–300	
		270–272	..	
		276–278	316–318	Difference is found from both maps except between Nos. 317–318 where it agrees with the Survey of India sheet.
22 Do.	Mettupatti	315–317	..	The ground tallies with the Survey of India sheet for some distance after which it follows the village map.
23 Do.	Valayapatti	343–344	..	Differs both from village map and Survey of India sheet.
24 Do.	Mulaiyur	52–53	215–216	Only ground and Survey of India sheet tally.
		25–26	80–82	Between cairns Nos. 80–82 the boundary on ground differs from both. Between Nos. 82–83 agrees only with the Survey of India sheet. Between Nos. 85–87 differs from both.
		26–27	82–83	
		80–82	85–87	
		9–10	22–23	Differs from Survey of India sheet and village map.
25 Erukale Hills	Do.	129–130	No numbers	Do.
26 Chembuli Hills	Reddiapatti	80–84	103–105	Do.
		92–93	113–114	Differs only from village plan.
		96–97	118–119	Do.
		107–110	132–134	Do.
		126–127	161–162	Differs from Survey of India sheet and village map.
		128–129	163–164	Differs only from village plan.
		2–17	No numbers	Do.
	Sathambadi	23–24	..	Do.
		25–27		
		27–28		
		30–31		
28 Alagar Hills	Kasampatti	337–339	337–339	Differs from village map.
		341–342	341 A–342	
29 Do.	Sellappanaickenpatti.	213–215	213–215	Do.
30 Do.	Lingavadi	133–138	200–206	Do.
		142–145	209–212	
		147–150	218–219	
31 Do.	Reddiapatti	185–191	253–256	Do.
		180–181	245–247	
32 Karandamalai	Kanavaipatti	110–120	111–120	Agrees with the Survey of India sheet except between Nos. 113–117.
		90–91	90–91	Differs from the village map.
33 Do.	Punnapatti	528–530	111–113	As per the village plan the boundary is a straight line from 528–530 while on the ground a small triangular area is included between these cairns.
34 Do.	Nedumandalam	..	344–346	Slight difference.
35 Do.	Punnapatti	471–475	551–552	Portion disreserved for temple as per Notification No. 33, dated 21st January 1927 is not shown in the village map or Survey of India sheet.
36 Mottamalai–Nedumalai.	Uralipatti	..	93–94	Ground differs from the village map in these two places.
			81–82	
37 Kiluvamalai	Mudavanpatti	85–87	85–86	Differs only from the village map.
38 D	Adanur	48–49	No numbers	Do.
		43–44		
		42–43		
39 Do	Sattivathondamanpatti.	169–170	74–75	Do.
		157–158	47–48	
40 Do.	Adanur	10–12	148–150	Do.
		15–16	151–152	
		20–21	158–159	

APPENDIX II.

STATEMENT SHOWING THE LENGTHS OF COMMON ZAMIN BOUNDARIES TO BE MAINTAINED IN MADURA FOREST DIVISION.

Name of State or zamindari.	Reserve which it adjoins.	Total length of boundary in miles.	Length to be maintained in miles.	Remarks.
		KODAIKANAL RANGE.		
1 Kannivadi	Mankaradu	4	..	Boundary runs on ridge. Need not be maintained.
2 Bodinayakanur.	Amburuvi	5	2	One mile each way beyond the natural boundary, the stream, to be maintained.
	Tambirankanal Agamalai.	9½	9½	Whole length to be maintained.
	Ampthill Downs.	12	1¼	Length between Pambadi shola and Ulamparai to be maintained.
3 Travancore	Do.	10	..	Need not be maintained as per Government Order.

Statement showing the lengths of common zamin boundaries to be maintained in Madura Forest Division—*cont.*

Name of State or zamindari.	Reserve which it adjoins.	Total length of boundary in miles.	Length to be maintained in miles.	Remarks.
		PALNI RANGE.		
1 Kannivadi ..	Marudanadiar ..	5	3	Of the 5 miles, 2 miles are at present clear. Of the 3 miles to be maintained 2 miles in the plain require first clearing. The remaining one mile—$\frac{1}{2}$ mile each way on the hill slope, requires maintenance once in 5 years.
	Pambukallar ..	3	1	A stream forms the boundary for 2 miles, only from Kalimanthurai point 3,474 feet up to Cairn 98 on the Survey of India sheet the boundary has to be maintained.
	Kodavanar ..	$1\frac{3}{4}$	$1\frac{1}{8}$	Needs maintenance for only one furlong.
	Kokkuparai ..	4	$2\frac{1}{4}$	Of the 4 miles, only $2\frac{1}{4}$ miles adjoin the zemin limits, while the balance adjoins the Athukad enclosure of Kodaikanal taluk.
	Siruvathukadu ..	4	3	The whole length of the boundary excepting from Pachamalai to Palichikombai has to be maintained.
	Northern Slopes, R.F.	$4\frac{1}{2}$	..	The boundary runs on the knife edge of a spur and so needs no maintenance.
2 Velur	Do. }	1 }	..	The boundary is clear for 4 miles and the concerned beat subordinates can maintain the whole line including the balance of one mile.
	Vennilai .. }	4 }		
3 Rettiambadi ..	Kudiraiyar ..	$6\frac{1}{2}$	..	The boundary is at present clear and the beat subordinates who have no other work to do, may keep it clear.
	Oliyanthuthu .. Poombarai—Vilpatty Valley.	..	..	In these two reserves the boundary adjoins mostly cultivated lands in the zemin limits and the existing boundary which is clear may continue to be maintained by the beat subordinates.
4 Ayakudi ..	Do.	8	4	Minor differences between the line traceable on the ground and that marked in the Survey of India sheet are noticed between Yelakuttam and the plains. The boundary requires maintenance for this length up to Yelakuttam (point 3,745 feet) from where up to point 6,179 feet it is the knife edge of a spur. From Pallamalai to the southern end, the line mostly passes through grassy area but it requires maintenance.
	Vennilai	3	3	The boundary requires maintenance.
	Kanienkadu ..	4	$1\frac{3}{4}$	Excepting for the distance of nearly $2\frac{1}{4}$ miles wherein Parappar is the common boundary, the balance bits towards north and south has to be maintained.
	Kallar koviladi .. }	3 }	..	The boundary runs from peak to peak in these reserves and lies almost entirely in grassy area, so need not be maintained.
	Kadavumalai .. }	}		
	Mulayar ..	4 }		
		CUMBUM RANGE.		
1 Travancore ..	Kombai	12 }	..	Need not be maintained as per Government Order.
	Machakal ..	$4\frac{1}{2}$ }		
	Suranganar ..	7 }		
	Melgudalur ..	3 }		
	Vannathiparai ..	8 }		
2 Tea Estates, India, Ltd.	Do. ..	8 }		The boundary was finally demarcated only about 1930–31 and for the most part lies on the edge of a ridge. A cleared boundary with cairns and survey stones exists on the ground for the present.
	Suruli Block ..	2 }		
	Kuthanachiar ..	2 }		
3 Gandamanaikanur.	Do. ..	$1\frac{1}{2}$	$1\frac{1}{2}$	Has to be maintained as a tea plantation is being formed adjoining this.
4 Erasakkanayakanur.	Do. ..	$2\frac{1}{4}$	$\frac{1}{2}$	The boundary for the most part is a stream. It has to be maintained from Athumottai to the new cardamom leased area.
	Suruli Block ..	$1\frac{1}{2}$	$\frac{1}{2}$	Needs maintenance for 4 furlongs above Varattar which forms the boundary for the remaining length.
	Dhonikaradu ..	2	..	Varattar forms the common boundary throughout the entire length.
5 Thevaram ..	Kombai	$1\frac{1}{4}$	$1\frac{1}{4}$	The boundary was cleared and demarcated in 1933–34 but it has to be maintained.
		SHOLAVANDAN RANGE.		
1 Gandamanaikanur.	Andipatti, South.	2	$\frac{1}{2}$	Except for $\frac{1}{2}$ a mile the whole length is being early burnt every year.
2 Elumalai ..	Do. ..	3	..	This portion lies at the north-western end when the boundary descends down to the plains. The whole portion is being early burnt every year.

Statement showing the lengths of common zamin boundaries to be maintained in Madura forest division—*cont.*

Name of State or zamindari.	Reserve which it adjoins.	Total length of boundary in miles.	Length to be maintained in miles.	Remarks.
		SHOLAVANDAN RANGE.		
3 Doddappanaickanur.	Andipatti South.	9	2	Only 2 miles not possible to be early burnt for want of grass has to be maintained. 7 miles are being early burnt.
	Andipatti, North.	$2\frac{3}{4}$	$2\frac{3}{4}$	To be maintained.
	Rajadhani ..	2	2	Do.
4 Uthappanaickanur.	Do. ..	2	2	Do.
	Valayapatti ..	2	$\frac{1}{2}$	$1\frac{1}{2}$ miles of boundary lie along knife edge. The western end only needs maintenance.
	Vikramangalam.	$\frac{1}{2}$ }	..	The boundary for most part is on the knife edge of the two hills, and is clear owing to the fact that no tree growth is allowed to survive in the zemin limits.
5 Thimmanatham.	Do. ..	5 }		
6 Poduvarpatti.	Do. ..	2 }		
7 Ammayanaickanur.	Do. ..	4 }		
	Sirumalai and North West Slopes.	16 } 8 }	7	Over 17 miles of this boundary is being early burnt every year and in between them are stretches of semi shola growth, where the boundary is not traceable. These lengths to an aggregate of 7 miles have to be maintained.
8 Vellodu ..	Do.	3	$1\frac{1}{2}$	The boundary requires maintenance for a length of $1\frac{1}{2}$ miles in 3 bits. (*a*) From point 1,183 feet to cairn 18, (*b*) From cairn 23 to the place where it joins the bridlepath, and (*c*) From the bridlepath to cairn 88 to the east of Kannimar Koil.
9 Meenakshi Devasthanam.	Sirumalai ..	4	..	This is being early burnt every year except $\frac{1}{2}$ a mile in the south-western end which is maintained by the beat subordinates.
	Waguthumalai ..	$1\frac{1}{2}$	..	The area on the other side is devoid of growth and is grassy, but it is being early burnt every year.
		NATHAM RANGE.		
1 Marungapuri ..	Vellimalai Nedumalai.	3	3	The boundary has many bends and so needs maintenance.
		AYYALUR RANGE.		
1 Kadavur ..	Mogavanur ..	2	..	The present cleared boundary is to be maintained by beat subordinates.
	Semmalai I and II.	$5\frac{3}{4}$	$1\frac{1}{2}$	To be maintained from the northern corner of the reserve wherefrom the boundary runs up the hill slope towards south.
	Thoppaswamimalai.	$10\frac{3}{4}$	4	A length of 4 miles in bits in the following places requires maintenance, (*a*) Southern end where the boundary runs down the hill slope, (*b*) From peak 3,017 feet northwardst ill the boundary crosses the R. Kombai Mungankottai footpath and (*c*) From the north-west corner towards south till where it follows the old fortification.
	Mungilkaradu.	2	$1\frac{1}{2}$	Excepting half a mile in the eastern end the balance portion to be maintained.
2 Puduvadi ..	Methalamalai ..	$1\frac{1}{2}$ }	..	The boundary in both the reserves is being maintained by the beat subordinates.
	Pakkirkaradu ..	$1\frac{1}{2}$ }		
3 Marungapuri ..	Sorupam ..	$2\frac{1}{2}$	$1\frac{1}{2}$	Two bits to be maintained (*a*) The continuation of the common boundary from Panjanthangi till it reaches the main ridge (*b*) In the western end where the boundary runs down the slope towards Kumarikatti.
	Panjanthangi Valley.	1	1	To be maintained as the boundary lies along a hill slope.
	Kumarikatti ..	5	1	In continuation of western end of Sorupam till it reaches the main ridge.
	Puthanatham (Palamalai).	5	..	The whole length is at present to be maintained by beat staff.
	Kaluvadimalai ..	$2\frac{3}{4}$	$2\frac{3}{4}$	The whole length to be maintained for want of any natural boundaries.
	Pillayarnatham.	5	3	The boundary to be maintained in the following bits :— (*a*) From the trijunction point 2,402 feet till the boundary crosses the Kannanuthu Odai, and (*b*) To the east of this Odai for over a length of 6 furlongs till the boundary reaches the the knife edge on top. The small length, where the boundary descends down to the plains towards south to be maintained b y beat staff.
	Total ..	$61\frac{1}{2}$		

APPENDIX III.

LIST OF SHOLAS IN THE UPPER PALNIS NOT UNDER SPECIAL FIRE PROTECTION.

Ampthill Downs Reserve.

1 Shenkese kadu.
2 Karinthan kadu shola.
3 Polachi Ar shola.
4 Vattathannir kanal.
5 Nedun kadu.
6 Nukkudu shola.
7 Malay kadu.
8 Varala kadu.
9 Arin kadu shola.
10 Mattupatti kadu.
11 Kummanan kadu.
12 Pilsuli kadu.
13 Erikal kadu.
14 Kathni shola.
15 Perunkanal.
16 Pulichi shola.

Gundar Valley Reserve.

1 Velampakkam shola.
2 Elu madu piliadichan kanal.
3 Kalran kavai kanal.
4 Kudukkan kanal.
5 Kotta kavai kanal.
6 Makkum purai kanal.
7 Kuttukal kadu.

Near Kodaikanal town.

1 Nettle shola.
2 Bombay shola.
3 Glenfalls shola.
4 Anagiri shola.

NOTE.—These sholas together with those under special fireprotection complete the bits of shola existing on the upper palnis.

APPENDIX IV.

LIST OF PHOTOGRAPHS TAKEN IN 1935.

Number.	Description of the place from which the photograph was taken.
1 to 4	*Kukkal shola.*—From a point a little below the top of the grassy hill just behind Kukkal resthouse.
5 to 7	*The pine plantations and sholas.*—From a hill peak immediately to the left of the footpath leading to Vembadishola peak about 22 chains along the footpath separating from saddle 7833 on the Kodaikanal—Mannavanur bridlepath. (Vide 2 inches map.)
8 to 10	*Vannampatty shola.*—From the sheetrock immediately to the left of the bridlepath at 1 mile 3 furlongs 7 chains on the Poombarai Kukkal bridlepath.
11 and 12 ..	*Shola shoriar.*—From a point on the Kukkal—Poombarai bridlepath 5½ chains from the mile-stone marked 3 miles 6 furlongs from Kukkal. (Four miles from Poombarai.)
13 and 14 ..	*Nedunkanal.*—From the sheetrock below and about 2 chains to the south of the top of the spur (on which there is a heap of stones to the west of point 17 miles 4 furlongs and 3 chains, on the Kodaikanal—Kavunji (Goschen) road.
15 to 17	*Perunkanal.*—From a point half a chain from the right of way and half a chain from the *Acacia* tree between 37/2 and 37/3 mile on the forty mile round road (Goschen road).
18 and 19 ..	*Marianshola.*—From a point 5 miles and 2 furlongs and 5 miles and 3 furlongs on the road to Kavunji, behind Marianshola resthouse.
20	*Manthankadu shola.*—From the junction of the Bodinaikanur—Kavunji footpath and Marianshola—Vandaruvu bridlepath about 4 furlongs from Marianshola resthouse.
21	*Pookadu shola.*—From a point 18 miles 3 furlongs from Kodaikanal on Marianshola—Vandaruvu top bridlepath.
22	*Avaraipallam shola.*—From the sheetrock to the left of Avaraipallam stream immediately above the waterfall behind the Poombarai resthouse. The Poombarai irrigation channel takes off from here.
23	*Narianagar shola.*—From the sheetrock on the saddle opposite to the shola reached from Poombarai resthouse along the footpath that goes up to the left of the forty mile round road from the 29th milestone.
24	*Tulukad and part of Pattur kanal.*—From the 12th mile 1 chain from Kodaikanal on the forty mile round road (Goschen road).

LIST OF PAINTINGS MADE IN 1918.

1	*The lower catchment of the Gundar.*—From a point on the 12 mile round road 4 chains forwara from the furlong stone indicating 37 miles 3 furlongs.
2	*The Avaraipallam Valley above Poombarai.*—From the sheet rock to the left of the Avaraipallam stream immediately above the waterfall behind the Poombarai resthouse. The Poombarai irrigation channel takes off from here.
3	*The Nariyanagar Valley above Poombarai.*—From the sheet rock on the saddle opposite to the shola, reached from the Poombarai rest house along the footpath that goes up the hill to the left of the 40 mile round road, from the 29th milestone.
4	*The Vannampattiar between Poombarai and Kukkal.*—From the sheet rock immediately to the left of the Poombarai—Kukkal bridlepath at one mile three furlongs and seven chains.
5	*The Sholasoraiar,* between *Poombarai and Kukkal.*—From a point on the Kukkal—Poombarai bridlepath 5½ chains from the milestone marked 3 miles 6 furlongs from Kukkal. (4 miles from Poombarai.)
6 (*a*) and (*b*) ..	*The beautiful Kukkal shola with the main source of an important river.*—From a point a little lower down from the top of the grassy hill just behind the Kukkal resthouse.

APPENDIX V.

Statement showing the dates on which the existing cardamom leases are due to expire.

Date of expiry of lease.	Number of leases.	Remarks.
	Palni Range.	
31st March 1936 ..	57, 59, 59 A and 60.	
31st December 1936 ..	62 and 19 K.	
31st March 1938 ..	20 K.	
31st December 1939 ..	4.	
31st December 1941 ..	25 K, 28 K, 29 K, 63, 64, 65, 66, 66 A, 67, 68, 69, 70, 71, 72 and 73.	
31st March 1942 ..	10.	
31st December 1942 ..	74, 75 and 76.	
31st March 1944 ..	1, 3, 5 A, 5, 9, 13 and 79	1, 5 A, 5 and 13 Unreserves.
30th September 1944 ..	43 K.	
31st December 1944 ..	7	7 Unreserve.
31st March 1945 ..	8 and 78	8 Unreserve.
31st December 1945 ..	83.	
31st March 1946 ..	15.	
30th June 1946 ..	12	12 Unreserve.
31st March 1947 ..	11, 14, 16, 17, 18, 77 and 80.	
31st December 1947 ..	81 and 82.	
31st March 1948 ..	20 and 28.	
30th June 1948 ..	19 and 84.	
30th November 1948 ..	26 and 27.	
31st March 1949 ..	2	2 Unreserve.
7th June 1950	87.	
8th June 1950	85.	
19th June 1950	90.	
6th July 1950	86.	
1st September 1950 ..	88.	
1st October 1950 ..	89.	
24th October 1950 ..	91, 92, 93 and 94.	
15th December 1950 ..	95 and 96.	
18th January 1951 ..	97.	
9th March 1951 ..	98.	
26th March 1951 ..	101 and 102.	
28th March 1951 ..	100.	
29th March 1951 ..	99.	
30th April 1951 ..	105.	
12th May 1951	103.	
21st May 1951	104.	
30th July 1951	106.	
5th August 1951 ..	111.	
17th November 1951 ..	110.	
16th January 1952 ..	107, 108 and 109.	
17th January 1952 ..	113.	
8th May 1952	117.	
9th May 1952	112 and 114	112 Unreserve.
10th May 1952	116 and 123.	

STATEMENT SHOWING THE DATES ON WHICH THE EXISTING CARDAMOM LEASES ARE DUE TO EXPIRE—*cont*.

Date of expiry of lease.	Number of leases.	Remarks.
	Palni Range—cont.	
13th May 1952	124 and 127.	
14th May 1952	118	118 Unreserve.
29th June 1952	121	121 Do.
15th July 1952	21 K.	
1st September 1952	132	132 Unreserve.
5th October 1952	130 and 131.	
11th November 1952	128.	
13th November 1952	119 and 125.	
28th November 1952	120	120 Unreserve.
17th December 1952	122.	
24th January 1953	129.	
3rd February 1953	126.	
14th April 1953	140.	
15th April 1953	143.	
16th April 1953	134, 137 and 139	134 Unreserve.
5th May 1953	135.	
6th May 1953	138.	
13th July 1953	136.	
30th September 1953	21, 22, 23, 24, 25, 29 and 12 K	25 Unreserve.
3rd October 1953	141.	
16th October 1953	145.	
9th November 1953	142.	
19th November 1953	144.	
18th March 1954	146	146 Unreserve.
30th April 1954	147.	
25th June 1954	149.	
30th June 1954	30, 30 A, 31, 32, 33, 34, 35, 36, 37, 38 and 39	30 A and 34 Unreserves.
17th July 1954	150, 152 and 153.	
9th September 1954	154 and 155.	
14th September 1954	156.	
23rd September 1954	160.	
28th September 1954	157.	
3rd October 1954	158.	
11th October 1954	159.	
29th October 1954	163	163 Unreserve.
31st October 1954	164, 165 and 166	164, 165 and 166 Unreserves.
15th November 1954	162	162 Unreserve.
31st December 1954	184	184 Do.
12th February 1955	171	171 Do.
18th March 1955	167, 168, 169 and 173	173 Do.
24th March 1955	170.	
31st March 1955	41, 42, 43, 44, 46, 46 A, 47 and 53	47 Unreserve.
15th May 1955	174	174 Do.
16th May 1955	177	177 Do.
18th May 1955	175.	
19th May 1955	172.	
22nd May 1955	181.	
23rd May 1955	178 and 179	178 and 179 Unreserves.
24th May 1955	176	176 Unreserve.
21st June 1955	183	183 Do.
30th June 1955	49, 50 and 51.	
19th July 1955	182.	
6th September 1955	185.	
6th June 1956	14 K.	
30th September 1956	52.	
31st March 1957	54.	
31st May 1957	6 and 1.	
31st July 1957	186.	
14th September 1957	48.	
30th September 1957	40.	
31st December 1957	55.	
24th March 1959	187.	
14th November 1959	188, 189, 190, 191 and 192.	
30th November 1959	193.	
14th February 1960	194, 195 and 196.	

STATEMENT SHOWING THE DATES ON WHICH THE EXISTING CARDAMOM LEASES ARE DUE TO EXPIRE—*cont.*

Kodaikanal Range.

Date of expiry of leases.	Number of leases.	Remarks.
31st December 1941 ..	23, 24, 26, 27, 30, 31, 32, 33, 34, 40 and 152.	
30th June 1942	35.	
31st April 1943	38.	
31st July 1945	44.	
23rd March 1947 ..	22.	
18th August 1947 ..	46.	
31st March 1948 ..	2.	
31st July 1948	45.	
20th July 1951	47.	
3rd October 1951 ..	81.	
30th November 1951 ..	57.	
4th February 1952 ..	50, 51, 53 and 56.	
4th March 1952 ..	58, 60, 61, 75 and 80.	
31st March 1952 ..	48, 49, 52, 54, 55 and 59.	
12th July 1952	62.	
3rd August 1952 ..	79.	
22nd August 1952 ..	63.	
3rd September 1952 ..	78 and 150.	
5th September 1952 ..	73, 77, 65 and 66.	
9th September 1952 ..	64.	
15th September 1952 ..	69, 70, 71, 72 and 74.	
16th September 1952 ..	76.	
24th September 1952 ..	68.	
26th September 1952 ..	82.	
28th February 1953 ..	83.	
31st March 1953 ..	3, 4, 5, 6, 6 A and 149.	
28th April 1953 ..	84 and 151.	
26th August 1953 ..	92, 93, 94, 95, 96, 97, 98, 99, 100, 101 and 102.	
12th September 1953 ..	103 to 110, 115 to 119, 121 to 125, 134 to 144, 153 and 157.	
27th September 1953 ..	85 and 86.	
5th October 1953 ..	91.	
7th October 1953 ..	126.	
9th October 1953 ..	88, 89 and 111.	
26th October 1953 ..	113 and 133.	
7th November 1953 ..	130.	
13th November 1953 ..	87 and 90.	
15th December 1953 ..	112.	
27th January 1954 ..	114.	
31st March 1954 ..	8.	
13th July 1954	127.	
23rd July 1954	128.	
3rd August 1954 ..	129	129 Unreserve.
6th September 1954 ..	131.	
25th September 1954 ..	132.	
30th September 1954 ..	9 and 9 A.	
17th November 1954 ..	154.	
4th December 1954 ..	145, 146, 147 and 148.	
16th February 1955 ..	167 to 173.	
23rd March 1955 ..	41.	
21st June 1955	164.	
24th June 1955	162.	
25th June 1955	166.	
24th July 1955	158, 161 and 163	158 Unreserve.
2nd August 1955 ..	165.	
20th August 1955 ..	159.	
9th September 1955 ..	160.	
28th August 1956 ..	174.	
30th June 1957	175.	
14th July 1957	176.	
31st July 1957	177 to 183.	
14th August 1957 ..	184 and 185.	
24th January 1958 ..	186 and 187.	
14th February 1958 ..	188 and 189.	
19th March 1958 ..	190 and 191.	
24th May 1958	192 and 193.	

STATEMENT SHOWING THE DATES ON WHICH THE EXISTING CARDAMOM LEASES ARE DUE TO EXPIRE—*cont.*

Date of expiry of leases.	Number of leases.	Remarks.
	Kodaikanal Range—cont.	
4th June 1958	194.	
14th February 1959 ..	195, 196 and 197.	
31st March 1959 ..	1.	
19th April 1959 ..	198 to 213.	
30th April 1959 ..	214 to 221.	
19th September 1959 ..	222 to 236.	
21st April 1965	11.	
	Cumbum Range.	
14th February 1954 ..	1.	
15th April 1954 ..	9, 10 and 15.	
23rd April 1954 ..	7.	
1st May 1954	4, 5 and 6.	
7th May 1954 ..	2.	
29th May 1954	12 and 16.	
26th June 1954	11 and 14.	
17th July 1954	17 and 22.	
20th July 1954	19.	
2nd August 1954 ..	20.	
4th August 1954 ..	21 and 25.	
17th August 1954 ..	23.	
22nd October 1954 ..	24.	
17th December 1954 ..	26.	
20th May 1955	29 and 30.	
24th May 1955	27.	
8th June 1955	28.	
11th July 1955	31 and 32.	
10th November 1955 ..	34 and 35.	
14th July 1957	36.	
31st July 1957	37 to 39.	
24th January 1958 ..	40.	
28th February 1958 ..	41.	
14th March 1958 ..	42.	
31st March 1958 ..	43.	
14th April 1958 ..	13.	
14th July 1958	8.	

APPENDIX VI (*a*).

Nursery Ledger.

Clearfelling Working Circle and *Eriodendron* planting.

Nursery to be sown in year. Size— Acres Units— Number of beds sown— Quantity of seed used—
Number of beds— Size of beds— Method of sowing—
Whether new nursery, or old nursery used for years previously. *Method of raising stumps—
Estimated number of $\frac{\text{stumps}}{\text{seedlings}}$ required. †Number of beds of transplants Espacement of transplants—
Actual number of $\frac{\text{stumps}}{\text{seedlings}}$ produced— Remarks on stocking of bed, amount of failure, etc.—

Year and month.	Clearing and burning.	Uprooting stumps.	Fencing.	Formation of beds.		Cost of seed including treatment.	Cost of sowing.	Watering.	Weeding, thinning and other tending.	Transplanting in nursery.	Preparation of stumps.	Number of stumps prepared.	Other items of expenditure (specify).	Remarks.
				Original.	Reforming.									
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)

* Whether direct in original seed beds, or by transplanting to nursery lines.
† To be filled in only if transplanting is done.

Species. Disposal of plants and cost. Grand total Rs.
Where used. Number of plants. Cost. Total cost per 1,000 stumps Rs.

APPENDIX VI (*b*).

Ledger for Gap Regeneration.

Selection Working Circle.

Working Circle.
Felling series.
Number of coupe regenerated. Area. Acres.
Number of gaps regenerated.
Average number of patches per gap.
Species introduced.
Distribution of species in gaps.

Subordinate staff in special charge.
Wages of coolies.
Average stocking of gaps at beginning of second growing season.
Average stocking of gaps at beginning of third growing season.

Year and month.	Clearing the ground.	Staking and preparation of the ground.	Cost of seed.	Sowing at stake.	Cost of stumps.	Stump planting.	Replacement of casualties.	Freeing, weeding and soil working.	Other expenditure [specify details in column (11)].	Details of other expenditure.	Total cost at end of each year.	Total cost per acre at end of each year.	Average cost per gap at end of each year.	Remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	

APPENDIX VI (*c*).

Regeneration Ledger.

Clearfelling Working Circle.

Year of plantation.

Date of timber felling from to

Date of clearfelling from to

Date of burning,

Date of piling and re-burning from to

Date when the cultivator left the coupe.

Subordinate establishment in special charge.

Rate of daily wages or coolies.

Compartment. (1)	Section or sub-compartment. (2)	Area in acres. (3)	Species introduced. (4)	Area of each species introduced. (5)	Espacement. (6)	Method of regeneration. (7)	Date of sowing or planting of each species. (8)	Remarks. (9)

Percentage of stocking at beginning of second growing season for each species separately.
- Teak .. .. per cent.
- *Dalbergia latifolia* .. .. .. per cent.
- *Pterocarpus marsupium* .. .. per cent.

Percentage of stocking at beginning of third growing season.
- Teak .. .. per cent.
- *Dalbergia latifolia* .. .. .. per cent.
- *Pterocarpus marsupium* .. .. per cent.

Year and month. (1)	Clear-felling. (2)	First burn. (3)	Piling and re-burning. (4)	Cost of seed. (5)	Proportion of nursery costs. (6)	Aligning and staking. (7)	Making inspection paths. (8)	Dibbling seed at stake (original). (9)	Stump planting (original). (10)	Replacing casualties. (11)	Freeing, weeding and soil working. (12)	Fire protection. (13)	Other expenditure [specify details in column (15)]. (14)	Details of other expenditure. (15)	Monthly rainfall in inches. (16)	Remarks. (17)

APPENDIX VI (*d*).

RAB REGENERATION LEDGER.

Name of Felling Series.
Range.
Year of Regeneration.
Name of Kumridars.
Name of field crop sown and date of sowing.
Date of harvesting of field crop.
Date of evacuation by Kumridar.

Number of coupe regenerated.
Area of coupe.
Number of Rab lines.
Average number of seed patches of line.

Nature of operations.	Date of operations.	Total cost.	Rate of coolie wages.	Species sown with proportions of total quantity sown.	At the beginning of second growing season.		At the beginning of third growing season.		Remarks.
					Number of successful patches.	Average number of seedlings per patch.	Number of successful patches.	Average number of seedlings per patch.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		RS. A. P.	RS. A. P.						

APPENDIX VI (*e*).

SANDAL WORKING CIRCLE.

Sandal Propagation Centres Journal.

Year.	Name of beat.	Locality.	Propagation centre.			Origin of sandal seed.	Name of host species introduced.	Date of sowing.		Date of first germination of sandal.	Date of completion of germination of sandal.	Replacement of casualties.		Survivals at the beginning of the second monsoon.		Survivals at the beginning of the third monsoon.		Remarks.
			Serial number.	Size.	How formed.			Sandal.	Host.			Date.	Number of seedlings.	Date.	Number of seedlings.	Date.	Number of seedlings.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1937–38	Virupakshi.	Mattupattikadu.	1	10′ × 10′	Clearing undergrowth piling and burning slash, wounding soil and forming shallow pits, well protected by a stout fence of junglewood poles 6′ high.	Lower Palnis.	Scutea indica and dhall.	25th May 1937.	25th May 1937.	20th June 19[illegible]	30th July 1937.	15th October 1937.	4	1st June 1938.	3	11th June 1939.	3	Sketch of locality enclosed. No watering was done.
			2	12′ × 12′														
			3	10′ × 12′														

APPENDIX VI (*f*).

Control Journal for the Fuel Working Circle.

A. Growing stock—

(i) Notes on growing stock, the relative fuel nature of various species, their distribution in the several felling series, etc.

B. Factors influencing the crop—

(i) Notes on various forms of climatic or natural damage to the crop.
(ii) Illicit fellings and other forest offences, and suggestions for preventing them.
(iii) Incidence of fire and comments on the necessity for or adequacy of the fire protection measures prescribed.
(iv) Notes on the extent to which climbers choke coppice growth and on the need, if any, for tending measures.
(v) Notes on *Barleria* and *Stenosiphonium* and other undergrowth.

C. Exploitation—

(i) Notes on the suitability of the present division into felling series with reference to the requirements of local markets.
(ii) Notes on the adequacy of the output of firewood.
(iii) Notes on the suitability of the rotation and the methods of working prescribed.
(iv) Detailed observations on—
  (1) the growth of coppice shoots,
  (2) causes for failure of coppice, and
  (3) relative coppicing power of different species.
(v) Notes on contractors and labour supply.
(vi) Statements of outturn realized from the several felling series and comparison with stockmaps.
(vii) Statements of prices realized per acre in each felling series and comments.
(viii) Comment on why any particular series could not be worked in any year.
(ix) Full account of deviations from the Working Plan, if any, with detailed justification.

D. Measures of improvement—

(i) Remarks on the conduct of fire protective operations and their results, with suggestions as to possible modifications in lay out.
(ii) Remarks on the degree to which the closure to grazing was enforced.
(iii) Presence of prickly pear and lantana.
(iv) Softwooded species.
(v) Suggestions for the improvement of communication and export routes.

E. Regeneration—

(i) *Natural regeneration.*—Observations on the extent of natural regeneration of various species.
(ii) *Seedling.*—Observations on the seedling of fuel species, time of seeding, etc.
(iii) *Artificial regeneration.*—Detailed comments on the success or failure of the *rab* and *kumri* regeneration measures prescribed, with reasons.
(iv) Suggestions for improvement or modifications of technique.
(v) Notes on the relative success attained with the various species attempted to be introduced—Notes on exotics introduced.
(vi) Notes on germinative power and plant per cent of seeds of various species.
(vii) Notes on pre-treatment of seeds.

F. Markets—

(i) Notes on the adequacy of the provision made for catering for various local markets.
(ii) Prices of firewood in important markets.

G. Statistical and Experimental—

(i) Notes on the rate of growth of fuel species based on measurements of coppice growth of known age and on ring countings.
(ii) Notes on experiments.

APPENDIX VI (*g*).

Control Book.

Brakepole Working Circle.

Year.	Prescriptions of the Plan.		Operations carried out.							Remarks.
						Yield.				
							Number of brakepoles.			
	Coupe number.	Area of coupe in acres.	Year of working.	Coupe number.	Area of coupe in acres.	Number of trees felled.	Class I.	Class II.	Revenue realized	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
									RS. A. P.	

APPENDIX VI (*h*).

Control Book.

The Minor Forest Produce Working Circle.

Year.	Prescriptions of the Working Plan.			Operations carried out.						Remarks.
	Kind of produce.	Unit of lease.	Period of lease.	Year.	Kind of produce.	Unit of lease.	Period of lease.	Yield.	Revenue realized.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

APPENDIX VI (*i*).

Sandal Working Circle.

Record of Works.

Year.	Prescriptions of the Working Plan.		Operations carried out.					Remarks.
	Nature of work.	Brief details of work.	Year.	Nature of work.	Brief details of work.	Cost of each item.	Total cost of each work.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
						RS. A. P.	RS. A. P.	
			A. Works prescribed.					
1937–38.	Tending of sandal plants ..	Tending of sandal in coupe I of Sholavandan Range, over 70 acres.	1937–38,	Tending of sandal plants.	Tending of sandal in coupe I of Sholavandan Range, over 70 acres.	10 0 0	10 0 0	
			B. Measures suggested.					
			C. Measures neither prescribed nor suggested.					

APPENDIX VI (*j*).

Control Book.

Selection (or) Clear-felling Working Circle.

Year,	Prescriptions of the Working Plan.					Operations carried out.									Remarks.
	Locality to be exploited.			Nature of felling.	Yield (if prescribed).	Year.	Locality exploited.			Nature of felling.	Details of yield.				
	Name of felling series.	Coupe number.	Area in acres.				Name of felling series.	Coupe number.	Area in acres.		Species.	Number of trees felled.	Number of logs.	Yield in c.ft.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)

APPENDIX VI (*k*).

CONTROL BOOK.

The Fuel Working Circle.

Prescriptions of the Working Plan.					Operations carried out.							Remarks.
	Locality to be exploited.					Locality exploited.						
Year.	Name of felling series.	Coupe number.	Area in acres.	Nature of fellings.	Year.	Name of felling series.	Coupe number.	Area in acres.	Nature of fellings.	Yield.	Revenue realzied.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
												Trees retained in the coupe— Tamarind. Below 1′ —.. 1′—2′ — 2 2′—3′ — 4 3′—4′ — 2 4′—5′ —.. 5′—6′ — 7 Over 6′ —10 Total —25 Sandal. Below 1′ —15 1′—2′ — 5 2′—3′ —.. Total —20

APPENDIX VI (*l*).

RECORD OF WORKS.

................Working Circle (Common to all Working Circles except sandalwood).

Prescriptions of the Working Plan.				Operations carried out.						Remarks.
Year.	Nature of work.	Locality.	Area in acres.	Year.	Nature of work.	Locality.	Area in acres.	Cost of each item.	Total cost of each work.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
				A. Works prescribed.						
				B. Measures suggested.						
			C. Measures neither prescribed nor suggested.							

APPENDIX VI (*m*).

CONTROL BOOK.

Bamboo Working Circle.

Prescriptions of the Working Plan.						Operations carried out.						
Year.	Locality to be exploited.				Revenue anticipated.	Year.	Locality exploited.				Revenue realized.	Remarks.
	Name of range.	Name of felling series.	Coupe number.	Area in acres.			Coupe number.	Area in acres.	Description.	Quantity.		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
					RS.						RS.	

APPENDIX VI (*n*).

Register of Deviations.

Year.	Working Circle.	Prescriptions.	Nature of deviation.	Reasons for deviation.	Remarks on any possible action to remedy the deviation.	Number and date of order sanctioning the deviation.
(1)	(2)	(3)	(4)	(5)	(6)	(7)

APPENDIX VI (*o*).

Annual Summary of Revenue and Expenditure—Madura Forest Division—193 .

Number and units.	Revenue realized.	Expenditure incurred.			Profit or loss.	Remarks.
		Capital.	Ordinary.	Total.		
	RS.	RS.	RS.	RS.	RS.	
1 The Selection Working Circle.						
2 The Clear-felling Working Circle.						
3 The Fuel Working Circle ..						
4 The Brakepole Working Circle.						
5 The Bamboo Working Circle.						
6 The Sandalwood Working Circle.						
7 The Minor Forest Produce Working Circle						
8 The Lac Working Circle ..						
9 The Protection Working Circle.						
10 Miscellaneous—						
Final demarcation ..						
Clearing boundaries ..						
Fire protection						
Grazing						
Roads and buildings ..						
Cardamoms						
11 Establishment (Pay, allowances, contingencies).						
12 Other items (Unreserves, fines, rents, etc.).						

APPENDIX VII (*a*).

List of trees and shrubs commonly found in Madura division.

Botanical name.	Tamil name.
Abrus precatorius	Kundumani.
Acacia arabica	Karuvai or Karuvelam.
Acacia concinna	Seekoy.
Acacia dealbata.	
Acacia decurrens.	
Acacia ferruginea	Parambai.
Acacia intsia	Indu or Vellindu.
Acacia latronum	Odai, Odaisithai, Mulsithai.
Acacia leucophloea	Velvelam.
Acacia melanoxylon.	
Acacia pinnata	Vellindu.
Acacia planifrons	Sithai, Sali, Kodaivela.
Acalypha fruticosa	Chinni.
Achryanthes bidenta.	
Acrocarpus fraxinifolius	Nelrai.
Achronychia laurifolia.	
Actinodaphne bourneii.	
Actinodaphne madraspatana.	
Adina cordifolia	Manjakadambai.
Agave sp.	Kathazhai, Manji.
Aglaia sp.	
Ailanthus excelsa	Pee maram.
Alangium lamarckii	Alinji.
Albizzia amara	Usal, Usil.
Albizzia lathami	Ooduusil.
Albizzia odoratissima	Selavagai.
Albizzia lebbek	Vagai.
Allophyllus cobbe.	
Allophyllus serratus.	
Alstonia scholaris	Eluilaipalai, Palai.
Anacardium occidentale	Munthiri.
Anemone rivularis.	
Anogeissus latifolia	Vekkali.
Anona squamosa	Sith pala maram.
Antidesma diandrum.	
Antidesma mensu.	
Arenaria neilgherrensis.	
Arisaema leschenaultii.	
Arisaema tortuosum.	
Aristolochia sp.	
Artocarpus integrifolia	Pila, Pela.
Artocarpus hirsuta	Peipila or Aini.
Asparagus sp.	
Atalantia monophylla	Kurundu, Kattelumichai.
Azadirachta indica	Vembu, Veppam.
Balsamodendron berryi	Mulkiluvai, Kiluvai.
Bambusa arundinacea	Perumungil, Mulmungil.
Barleria sp.	Karumkurunji.
Bassia latifolia	Kattiluppai.
Bassia longifolia	Illuppai.
Bauhinia racemosa	Athi.
Berberis tinctoria.	
Bischofia javanica	Malai puvarasu, Solai vengai.
Bombax malabaricum	Elavam, Olagu.
Borassus flabellifer	Pana maram.
Boswellia serrata	Vellai kungiliam.
Breynia patens.	
Bridelia retusa	Adamaruthu, Mul vengai.
Bridelia roxburghiana.	
Buchanania latifolia	Sarai.
Butea frondosa	Elai-porasu.
Cadaba indica.	
Cadaba trifoliata.	
Caesalpinia bonducella	Kalichi kai.
Casealpinia mimosoides.	
Caesalpinia sepiaria.	
Calamus sp.	Pirambu, Sural.
Callicarpa lanata.	
Calophyllum tomentosum	Sarakidamaram.
Calophyllum wightianum	Sarakidamaram.
Calotropis gigantea	Erukku.
Canarium strictum	Karun kungiliyam.
Canthium didymum	Navugu, Sulundu.
Canthium neilgherrense.	
Canthium parviflorum	Madukarai.
Capparis horrida	Athandan, Sengam.
Careya arborea	Kolama.
Carissa carandus	Kila.
Carissa spinarum	Siru kila.
Caryota urens	Kundal panai.
Casearia tomentosa	Nedunarai.
Casearia coriacea.	
Cassia auriculata	Avaram.
Cassia fistula	Konnai, Sarakonnai.
Cassia marginata	Senkonnai, Karunkonnai.
Cassia montana	Malai avaram.
Cassia tora	Tharai.
Cassia occidentalis.	
Cassia siamea	Ponnavaram.
Cassia tomentosa.	
Cedrela toona	Chandanavembu, Madagirivembu.
Celastrus paniculata.	
Celosia pulchella.	
Celtis wightii	Vellathovarai.
Chukrassia tabularis	Agil.
Chloroxylon swietenia	Porasu, Karumpurasu.
Chinnamomum wightii.	
Chinnamomum zelyanicum.	Lavangapattai.
Cipadessa baccifera.	
Cissampelos pareira.	
Clausena willdenovii	Ana.
Cleistanthus collinus	Odugin, Oduvai.
Clematis gouriana.	
Clematis wightiana.	
Clerodendron serratum.	
Cochlospermum gossypium.	Kudirai pudukuannu.
Coffea arabica	Kapi.
Combretum ovalifolium	Odai kodi.
Convolvulus flavus.	
Cordia fulvosa	Nariviti.
Cordia myxa	Kalvirusu, Virusu.
Cordia macleodii	Palantekku.
Cordia wallichii	Vazhukkai.
Cotoneaster buxifolia.	
Crataeva religiosa	Mavilingan.
Crotalaria sp.	
Croton sp.	
Cryptolepis Buchanani	
Cycas circinalis	Eenju, Petenju.
Dalbergia latifolia	Thodagathi, Eruputtu.
Dalbergia paniculata	Pachalai, Velluruvi.
Dalbergia sissoo.	
Dalbergia coromandeliana.	Viruvitta.
Daphniphyllum glaucescens.	
Datura stramonium	Umathai.
Dendrocalamus strictus	Sirumungil.
Derris canarensis.	
Derris scandens.	
Desmodium pulchellum.	
Desmodium rufescens.	
Dichrostachys cinera	Vedathela.
Dioscorea oppositifolia.	
Diospyros montana	Vakkanai, Vakkanathi.
Diospyros melanoxylon	Karuthali, Karumthumbi, Karunthovarai.
Dipsacus leschenaulti.	
Dodonaea viscosa	Virali.
Dolichandrone falcata	Kadalati.
Elaeagnus kologa.	
Elaeocarpus oblongus.	
Elaeocarpus ferrugineus.	
Elaeocarpus serratus.	
Elaeocarpus munroii.	
Elaeocarpus tuberculatus.	
Elaeodendron glaucum	Karukkuvachi.
Elettaria cardamomum	Elam.
Embelia robusta.	
Entada scandens.	
Eriodendron anfractuosum	Elavam.

List of trees and shrubs commonly found in Madura division—cont.

Botanical name.	Tamil name.
Erythrina indica	Kalyana murukku.
Erythrina suberosa	Mullu muruku.
Erythroxylon monogynum.	Sembulichan, Devadaru Semmana.
Eucalyptus globulus	Karpuram.
Eugenia jambolana	Naval.
Euonymus crenulatus.	
Euphorbia antiquorum	Kalli, Sathura kalli.
Euphorbia tirukalli	Tiruku kalli.
Eurya japanica.	
Evodia roxburghiana.	
Feronia elephantum	Vila.
Ficus sp.	
Flacourtia ramontchi.	
Flemingia grahamiana.	
Flemingia nilgherensis.	
Flueggea leucopyrus	Varaipoola.
Flueggea mycrocarpa	Vellapula.
Garcinia cambogia	Korukkapuli.
Gardenia sp.	Kalveerai.
Gardenia gummifera	Kumbli pisin.
Gardenia turgida	Malankarai.
Garuga pinnata	Udiyan.
Gaultheria fragrantissima.	
Girardinia heterophylla.	
Givotia rottleriformis	Vandalai.
Glochidion neilgherrense.	
Glochidion velutinum.	
Gloriosa superba.	
Gmelina arborea	Kumil, Kumbla.
Gmelina asiatica	Mulkumil, Nirkumil.
Gomphandra coriacea.	
Gordonia obtusa.	
Grewia laevigata	Marattai.
Grewia orbiculata	Uduppai.
Grewia tiliaefolia	Thadusu, Vazhukkai.
Gymnosporia montana	Elumullu.
Gymnosporia ovata.	
Gyrocarpus jacquinii	Tanakku.
Hardwickia binata	Acha, Usa.
Helicteres isora	Valampiri.
Hemicyclia sepiaria	Virai.
Hemidesmus indicus	Nannari.
Heracleum sp.	
Hiptage madablota	Madavi.
Holarrhena antidysenterica.	Palai, Veppalai.
Holigarna arnottiana.	
Holoptelia integrifolia	Avi, Aya.
Hopea parviflora	Kongu.
Hugonia mystax.	
Hydnocarpus wightiana	Maravattai.
Hydnocarpus alpina.	
Hymenodictyon excelsum	Pohilla maram.
Hypericum mysorense.	
Hypericum wightianum.	
Ichnocarpus frutescens	Uthalai-kodi.
Ilex wightiana.	
Indigofera sp.	
Ipomea sp.	Oonan kodi, Kakatan.
Isonandra candolleana.	
Ixora parviflora	Kora.
Jasmium sp.	
Jatropha curcas	Kattamanaku.
Kydia calycina	Vendai, Thuthi.
Lagerstroemia lanceolata	Vevala, Venteak.
Lansium anamalayanum.	
Lantana aculeata	Arippu.
Lantana camara.	
Laportea terminalis.	
Lasianthus coffeoides.	
Lasianthus venulosus.	
Lasiosiphon eriocephalus.	
Lawsonia alba	Marudhani.
Leea aspera.	
Lettsomia sp.	
Ligustrum roxburghii.	
Limonia acidissima	Naivela, Kattalumichai.
Limonia alata.	
Litsaea deccanensis.	
Litsaea stocksii.	
Litsaea wightiana.	
Lonicera leschenaultii.	
Loranthus sp.	Pulluruvi.
Maba buxifolia	Kattutuvarai, Karuntuvarai.
Machilus macrantha	Kolama.
Macaranga indica	Battakanni, Thenna.
Maesa perrottetiania.	
Mahonia escultei.	
Mallotus philippinensis	Kanapottu.
Mallotus albus.	
Mangifera indica	Mamaram.
Mappia foetida.	
Melia dubia	Malaivembu.
Meliosma wightii.	
Memecylon sp.	
Memecylon edule	Kayan.
Mesua ferrea	Nangal.
Michelia champaka	Shambakam.
Michelia nilagirica.	
Miliusa velutina	Pohanji.
Mimusops hexandra	Kanupalai.
Mimusops elengi	Magilan.
Morinda citrifolia	Manjanathi.
Morinda tinctoria	Nona.
Moringa pterygosperma	Kattumurungai.
Mucuna hirsuta.	
Mundulea suberosa	Vellaporasu.
Murraya exotica	Karuveppilai.
Musa sp.	Vazhai.
Mussaenda hirsutissima.	
Myristica attenuata	Amaie.
Myristica laurifolius	Jathikai.
Nauclea purpurea.	
Nephelium longana	Koorappu.
Ochlandra sp.	Ithai.
Ocimum sanctum	Thulasi.
Odina wodier	Udiamaram.
Oldenlandia articularis.	
Oldenlandia stylosa.	
Olea glandulifera.	
Opuntia dillenii	Kalli, Chapathikalli.
Osbeckia cupularis.	
Osbeckia lineolata.	
Osbeckia leschenaultii.	
Osbeckia reticulata.	
Osbeckia wightiana.	
Osyris arborea.	
Pandanus sp.	Thazhai.
Passiflora sp.	
Pavetta indica	Pavattai.
Phoebe wightii.	
Phoenix acaulis	Echan, Eenji.
Phoenix sylvestris	Echan.
Photinia notoniana.	
Phyllanthus emblica	Nelli.
Phyllanthus gardnerianus.	
Phyllanthus macraei.	
Phyllanthus rheedii.	
Pinus attenuata.	
Pinus insignis.	
Pinus maritima.	
Pinus sabiniana.	
Piper brachystachyum.	
Piper schmidtii.	
Pithecolobium dulce	Korukkapuli.
Pittosporum nilghirense.	
Pittosporum floribundum.	
Plectronia neilgherrensis.	
Plumeria acutifolia.	
Polyalthia cerosoides	Nedu narai.
Polygala arillata.	
Polygala rosemarinifolia.	
Polygala sibrica.	
Polygonum minus.	
Polygonum punctatum.	
Pongamia glabra	Pungam.
Porana malabarica.	
Premna cordifolia.	
Premna integrifolia	Minnai.
Premna tomentosa	Kolakattai thekku, Podanganari.
Prosopis spicigera	Vanni, Paramhai.
Protium caudatum	Senkiluvai, Malankiluvai.
Psychotria congesta.	
Pterocarpus marsupium	Vengai.
Pterolobium indicum	Karindu, Indu.
Pterospermum suberifolium.	Pilavu, Sembolugu.
Putranjiva roxburghii.	
Pygeum gardneri.	

List of trees and shrubs commonly found in Madura division—cont.

Botanical name.	Tamil name.
Pygeum wightianum ..	Irumbukanni.
Randia dumetorum ..	Karai.
Randia melabarica ..	Pidathi.
Randia Uliginosa	Kali karai.
Ranunculus reniformis.	
Ranunculus suppinnatus.	
Ranunculus wallichianus.	
Rhamnus virgatus.	
Rhamnus wightii.	
Rhododendron nilagiricum.	Puvarasu.
Rhodomyrtus tomentosa ..	Thavittu pazham.
Rhus mysorensis	Chennavarai.
Rosa leschenaultiana.	
Rubia sp.	
Rubus ellipticus	Seendu.
Rubus moluccanus.	
Rubus niveus.	
Rubus racemosus.	
Rumex nepalensis.	
Saccopetalum tomentosum.	
Salvadora persica.	
Santalum album	Sandana maram.
Sapindus emarginata ..	Naikottan . Poondhikottai.
Sarcococca trinervia.	
Schefflera racemosa.	
Schefflera stellata.	
Schefflera wallichiana.	
Schleichera trijuga ..	Pulichi.
Schrebera swietenioides ..	Mohalingam.
Scolopia crenata.	
Scutia indica	Thoratti.
Scutia myrtina.	
Semecarpus anacardium ..	Shenkottai, Serankottai.
Shorea talura	Kungiliyam.
Sideroxylon tomentosum.	
Smilax, sp.,	
Solanum sp.	
Soymida febrifuga.	
Spathalobus roxburghii ..	
Spondias mangifera ..	Kattuma.
Stellaria sp.	
Stephegyne parvifolia ..	Nirkadambai.
Sterculia foetida	Peenarimaram.
Sterculia guttata	Kudirai Pidukku maram.
Sterculia villosa.	
Stereospermum chelonoides.	Poombathiri.
Stereospermum xylocarpum.	Vedankorana.
Streblus asper.	
Strobilanthes sp.	Kurinji.
Strychnos nuxvomica ..	Kanjira, Yetti.
Strychnos potatorum ..	Thethan, Porithethan.

Botanical name.	Tamil name.
Swietenia macrophylla.	
Symplocos obtusa.	
Symplocos spicata.	
Syzygium arnottianum.	
Tabernaemontana heyneana.	Nandivattai.
Tamarindus indica ..	Puli.
Tectona grandis	Thekku.
Tephrosia tinctoria.	
Terminalia arjuna ..	Vellamarudu.
Terminalia belerica ..	Tani.
Terminalia catappa.	
Terminalia chebula ..	Kadukkai.
Terminalia paniculata ..	Adamatuthu, Pillamaruthu.
Terminalia tomentosa ..	Karumaruthu.
Tetrameles nudiflora.	
Thalictrum javanicum.	
Thespesia lampas ..	Kattuparuthi.
Thevetia neriifolia ..	Tiruvachippa.
Tiliacora racemosa.	
Toddalia aculeata	Milakaranai.
Toddalia asiatica.	
Trema orientalis	Meena, Ambaruthi.
Turpinia nepalensis.	
Urena lobata.	
Vaccinium leschenauliti.	
Vaccinium nilgherense.	
Vateria indica	Kunguliyam.
Ventilago madraspatana ..	Vembadan.
Vernonia arborea.	
Vernonia fysoni.	
Vernonia pulneyensis.	
Viburnum acuminatum.	
Viburnum coriaceum.	
Viola canescens.	
Viola patrinii.	
Viola serpens.	
Vitex altissima	Miladi.
Vitex negundo	Nochi.
Vitis sp.	
Walsura piscida.	
Webera corymbosa	Theranni, Pavattai.
Wendlandia notoniana.	
Wrightia tinctoria	Palai, Veppalai.
Zanthoxylum rhetsa.	
Zingiber officinalis ..	Ingi.
Zizyphus jujuba ..	Elandai.
Zizyphus oenoplia	Soorai.
Zizyphus rugosa	
Zizyphus trinervia ..	Karikattan.
Zizyphus xylopyrus ..	Mulkottan.

Tamil name.	Botanical name.
Acha (Usa)	*Hardwickia binata.*
Adamarudu	*Terminalia paniculata.*
Adamarudu	*Bridelia retusa.*
Adandai	*Capparis horrida.*
Agil	*Chukrassia tabularis.*
Aini	*Artocarpus hirsuta.*
Alamaram	*Ficus bengalensis.*
Alingi	*Alangium lamarckii.*
Amai	*Myristica attenuata.*
Ana	*Clausena willdenovii.*
Athi	*Bauhinia racemosa.*
Athi	*Ficus glomerata.*
Avaram	*Cassia auriculata.*
Avi (Aya)	*Holoptelia integrifolia.*
Buthalai (Vendalai) ..	*Givotia rotteleriformis.*
Chinni chedi	*Acalypha fruticosa.*
Devadari (Semmana) Sembulicha).	*Erythroxylon monogynum*
Echam	*Phoenix sylvestris.*
Elam	*Elettaria cardamomum.*
Elandai	*Zizyphus jujuba.*
Elavam (Elavan, Olagan).	*Bombaz malabaricum.*
Eluelaipalai	*Alstonia scholaris.*
Elumullu	*Gymnosporia montona.*
Eenju (peienju)	*Cycas circinalis.*
Erukkan	*Calotropis gigantea.*
Etti	*Strychnos nuxvomica.*
Ichi (kallichi)	*Ficus retusa.*

Tamil name.	Botanical name.
Idalai	*Olea sp.*
Ilaiporasu	*Butea frondosa.*
Ilavangapattai (Lavangapattai).	*Cinnamomum zeylancum.*
Iluppai (Kattiluppai) ..	*Bassia latifolia.*
Iluppai	*Bassia longifolia.*
Indu (Vellindu)	*Acacia pinnata, Acacia intsia.*
Indu (Karindu)	*Pterolobium indicum.*
Inji	*Zingiber officianalis.*
Ithai (Odai)	*Ochlandra travancorica.*
Jathikay	*Myristica laurifolia.*
Kadalathi	*Dolichandrone, falcata.*
Kadukkai	*Terminalia chebula.*
Kakkatan	*Ipomea sp.*
Kalichikai	*Caesalpinia bonducella.*
Kalikarai	*Randia ulginosa.*
Kaliyanamurukan (Murukan).	*Erythrina indica.*
Kalli (Kathazai)	*Opuntia dillenii.*
Kalli	*Euphorbia gen.*
Kalvirai (Virai)	*Gardenia sp.*
Kalvirusu	*Cordia myxa.*
Kamblipisin	*Gardenia gummifera.*
Kanaputtu	*Mallotus philippinensis.*
Kanupalai	*Mimusops hexandra.*
Karai	*Randia dumetorum.*

List of trees and shrubs commonly found in Madura division—cont.

Tamil name.	Botanical name.
Karikattan	*Zizyphus trinervia.*
Kariveppilai	*Murraya exotica.*
Karkuva (Karkuvachi)	*Eleodendron glaucum.*
Karpuramaram	*Eucalyptus globulus.*
Karumarudu	*Terminalia tomentosa.*
Karumporasu (Porasu)	*Chloroxylon swietenia.*
Karumthumbi	*Diosphyrus sp.*
Karumthovarai	*Diosphyrus sp.*
Karumthovarai	*Maba buxifolia.*
Karungali	*Acacia sundra.*
Karuppu kungiliyam	*Canarium strictum.*
Karuthali	*Diospyrus sp.*
Karuvai (Karuvelam)	*Acacia arabica.*
Kattamanakku	*Jatropha curcas.*
Kattelumachai (Kurundu).	*Atalantia monophylla.*
Kathalai	*Agave americana.*
Kattuma	*Spondias mangifera.*
Kaya	*Memecylon edule.*
Kila	*Carissa carandas.*
Kila (Sirukila)	*Carissa spinarum.*
Kiluvai (Mulkiluvai)	*Balsamodendron berryi.*
Kodaivelam (Sithai, Sali).	*Acacia planifrons.*
Kodukkapuli	*Pithecolobium dulce.*
Kolakattai thekku (Podanganari).	*Premna tomentosa.*
Kolama	*Careya arborea.*
Kongu	*Hopea parviflora.*
Konnai, Sarakonnai	*Cassia fistula.*
Koondapanai	*Caryota urens.*
Koorappu	*Nephelium longanum.*
Kora	*Ixora parviflora.*
Korukkapuli	*Garcinia cambogii.*
Kudirai piddukku	*Sterculia foetida.*
Kudirai piddukku	*Cochlospermum gossypium.*
Kumil (Kumbla)	*Gmelina arborea.*
Kundumani	*Abrus precatorius.*
Kungiliyam	*Shorea talura.*
Kungiliyam	*Vateria indica.*
Kura (Therani)	*Webera corymbosa.*
Kuringa	*Barleria sp., Strobilanthes sp.*
Madagirivembu, Sandanavembu.	*Cedrela toona.*
Madavi	*Hiptage madablota.*
Madukarai	*Canthium parviflorum.*
Magilam	*Mimusops elengi.*
Mailadi	*Vitax altissima.*
Malai avaram or konnai.	*Cassia montana.*
Malai vembu	*Melia dubia.*
Malai Poovarasu, Solaivengai.	*Bischofia javanica.*
Malamkarai	*Gardenia turgida.*
Malam kiluvai	*Protium caudatum.*
Mamaram	*Mangifera indica.*
Manjakadambai	*Adina cordifolia.*
Manjanathi, Nona	*Morinda citrifolia.*
Maravetti	*Hydnocarpus alpina* or *H. wightiana.*
Marudani	*Lawsonia alba.*
Mavilingam	*Crataeva religiosa.*
Milakaranai	*Toddalia aculeata.*
Minnai	*Premna integrifolia.*
Moggalinga	*Schrebera swietenioides*
Mulkottan	*Zizyphus xylopyra.*
Mullumarukku	*Erythrina Suberosa.* or *E. indica*
Mulvengai	*Bridelia retusa.*
Mungil, Perumungul and Mulmungil.	*Bambusa arundinacea.*
Mungil, Sirumungil	*Dendrocalamus strictus.*
Naivela	*Limonia acidissima.*
Nangal	*Mesua ferrea.*
Nannari	*Hemidesmus indicus.*
Narattai	*Grewia laevigata.*
Narivili	*Cordia fulvosa.*
Naval	*Eugenia jambolana.*
Navugu, Shulundu	*Canthium didymum.*
Nedunarai	*Polyalthia fragrans.*
Neerkumil	*Grewia asiatica.*
Neikottam	*Sapindus emarginatus.*
Nelli	*Phyllanthus emblica.*
Nelrai	*Acvocarpus fraxinifolius.*
Nirkadambai	*Stephegyne parviflora.*
Nochi	*Vitex negundo.*
Odai, Mulseethai	*Acacia latronum.*
Odugan	*Cleistanthus collinus.*
Oodian	*Odina wodier.*

Tamil name.	Botanical name.
Oodu-Usal	*Albizzia lathamii.*
Othalakode	*Ichnocarpus frutescens.*
Pachalai	*Dalbergia paniculata.*
Palai, Veppalai	*Wrightia tinctoria.*
Palai, Veppalai	*Holarrhena antidysenterica.*
Palantekku	*Cordia sp.*
Panamaram	*Borassus flabellifer.*
Parambai (Vanni)	*Prosopis spicigera.*
Parambai (Vanni)	*Acacia ferruginea.*
Pavattai	*Pavatta indica.*
Pavattai (Tharani)	*Webera corymbosa.*
Pee, Peemaram	*Ailanthus excelsa.*
Peenari	*Sterculia sp.*
Peiathi	*Ficus hispida.*
Pila	*Artocarpus integrifolia.*
Pirambu	*Calamus sp.*
Pirandai	*Vitis quadrangularis.*
Pidathi	*Randia malabaricum.*
Pohanji (Karinpohanji)	*Miliusa nilagirica.*
Ponnavaram	*Cassia siamea.*
Pulan, Vellapulam	*Flugia microcarpa.*
Puhaiilaimaram	*Hymenodictyon excelsum.*
Pora	*Streblus asper.*
Puli	*Tamarindus indica.*
Pulichi	*Schleichera trijuga.*
Pulluruvi	*Loranthus.*
Pumarudu	*Terminalia paniculata.*
Pumbathiri	*Stereospermum chelonoides.*
Pungam	*Pongamia glabra.*
Sadurakalli	*Euphorbia antiquorum.*
Sandanam	*Santalum album.*
Sarai	*Buchanania latifolia.*
Seekai	*Acacia concinna.*
Seetha	*Anona squamosa.*
Selavagai	*Albizzia odoratissima.*
Sengam	*Capparis sp.*
Serankottai	*Semecarpus, anacardium.*
Shanbagam	*Michelia champaka.*
Shembulugu	*Pterospermum suberifolium.*
Soorai	*Zizyphus oenoplia.*
Tagarai	*Cassia tora.*
Tanaku	*Gyrocarpus jacquinii.*
Tani	*Terminalia belerica.*
Tekku	*Tectona grandis.*
Tethan, Paithethan	*Strychnos potatorum.*
Thadasu	*Grewia tiliaefolia.*
Thothagathi, Itti	*Dalbergia latifolia.*
Thoratti	*Scutia indica.*
Thirugukalli	*Euphorbia tirucalli.*
Thulasi	*Ocimum sanctum.*
Uduppai	*Grewia orbiculata.*
Umattai	*Datura sp.*
Unangodi	*Lettsomia sp.*
Usil	*Albizzia amara.*
Vagai	*Albizzia lebbek.*
Vagai	*Albizzia odoratissima.*
Vakkanai	*Diospyros montana.*
Valai, Vazhai	*Musa* (*genus*).
Valampiri	*Helicteres isora.*
Valukkai	*Cordia myxa.*
Vandalai	*Givotia rottleriformis.*
Vanni	*Acacia ferrugenia.*
Vanni	*Prosopis spicigera.*
Vattakanni	*Macaranga roxburghii.*
Vedankoranai	*Stereospermum xylocarpum.*
Vedathbalan	*Dichrostachys cinerea.*
Veerai	*Hemecyclia sepiara.*
Vekkali	*Anogeissus latifolia.*
Velichi	*Gardenia coronaria.*
Vellakungilyam	*Boswellia serrata.*
Vellai marudu	*Terminalia arjuna.*
Vellai porasu	*Mundelea suberosa.*
Vellai thavarai	*Celtis wightii.*
Velvela	*Acacia leucophloea.*
Vembadan	*Ventilago madraspatana.*
Vengai	*Pterocarpus marsupium.*
Ventekku Veivila	*Lagerstroemia lanceolata.*
Veppalai	*Holarrhena antidysenterica.*
Veppam	*Azadirachta indica.*
Vila	*Feronea elephantum.*
Vilvam	*Aegle marmelos.*
Virali	*Dodonaea viscosa.*
Virivittan	*Dalbergia coromandoliana.*

APPENDIX VIII.

SECTION 1.—LIFE CYCLE OF THE LAC INSECT AND TERMS USED IN LAC OPERATIONS.

Life History of the Lac Insect.

1. Lac is the encrustation secreted by certain insects as a protective covering over themselves. The insects belong to several species of the family *Coccidae.*

A knowledge of the life history of the lac insect and of the terms used in lac operations will be found helpful in understanding the prescriptions of the Lac Working Circle, particularly to those who may be in charge of lac operations for the first time.

2. *The Larvæ.*—The newly born lac insects are tiny red creatures called *larvæ.* They are active and are capable of walking about for a considerable distance in search of a suitable host tree from which to suck their food. They crawl over the branches looking for suitable resting places and seem to prefer young succulent shoots. They instinctively settle on the underside of inclined shoots and all round vertical shoots. Having settled, the larva drives its long slender proboscis into the bark and sucks the sap. This proboscis is really its mouth parts drawn out into a tube for piercing and sucking. Once anchored the larva never moves again and is fixed for life. It continues to feed on the tree-sap and begins to grow.

3. *Lac secretion.*—In a few days a thin shining film may be noticed over the bodies of the larvæ. This substance is the secretion which is called lac. As the larvæ grow, secretion continues and coat of lac is added to from the inside. Lac is thus the resinous protective covering manufactured by the lac insects from the tree sap sucked in their life time. The Lac insects, being soft bodied and unable to move after settlement, need a thick encrustation to protect themselves against their enemies.

The larvæ settle on the twigs in large numbers often completely covering the surface of the shoots and almost touching one another. When they start to secrete lac the secretion from one insect coalesces with that from its neighbour and goes to form a continuous coat of lac called the *encrustation.*

4. *Males and females.*—The larvæ are of two kinds, male and female : they look alike. Usually more females than males occur in a brood.

5. As each larva grows its secretion forms a cell round it which is also termed a " test ". The cell of a male larva is thin and shaped like a cigar : that round a female is thicker and more or less oval. Lac insects are thus shut off from the outside, each enclosed in a cell of lac, with three small openings to the outside.

Through these three openings waxy white filaments proceed outwards. In a crop of healthy insects the growth of waxy white filaments is so profuse as to give the encrustation a woolly white appearance. This is taken as a sign of a healthy crop.

Two of these openings are *brachial pores* (breathing holes) and the third is the *anal cleft* or opening. The male cell has at one end a circular opening covered by the lid or *operculum* through which the male emerges when mature.

6. *Honey Dew.*—Through the anal cleft a sticky secretion called " honey dew " is excreted. It drips or washes down on to the leaves below or is gradually licked up by ants " It forms the nutrient material for a black fungoid growth which overspreads the upper surfaces of the leaves with a sooty black covering. This black appearance is quite characteristic of lac infected trees. The fungus appears to be a harmless saprophyte."

7. *Male emergence.*—When the males and females have become adults the males wriggle out of their cells by pushing open the lid or *operculum.* The males look similar to the lac larvæ and are red in colour. They possess legs but may or may not have wings. Their emergence is commonly called " male emergence ". After emergence the males crawl over the encrustation or, if winged, fly about and fertilise the females through the anal opening in the cells. Each male, after impregnating a number of females, dies of exhaustion and starvation as it does not feed after emergence. Male emergence may spread over a month but each male lives only for a few days. Males secrete very little lac as they live only for a short period and that mainly for the purpose of fertilization.

8. After the male swarming the encrustation is made up entirely of living female cells and the empty male cells. The females now secrete lac at a much greater rate because they take more food to supply the needs of the very large number of eggs developing in their ovaries. The encrustation too thickens rapidly and becomes a thick coating often completely surrounding the shoots.

9. As the eggs inside the female become nearly ripe cracks appear in the encrustation and an orange-yellow spot can also be noticed on the female cells. The body of the female which is now like a sac, seems by its contraction to leave a vacant space in the lac cell, which appears outside as an orange spot. Finally the eggs ripen and are expelled by contraction of the muscles into the incubating chamber of the *test*. Here the small red larvæ hatch out and crawl out of the incubating chamber and the cells. The mother insect remains alive at the time of emergence of the larvæ. She can control the swarm to some extent should weather conditions be unfavourable.

10. *Life cycle ; swarming.*—The process of growth from the tiny red larvæ to the full developed female *test* or cell containing young larvæ ready to swarm, is called " a life cycle" or " generation ", and the process of larval emergence from a cell is called " swarming."

11. All the eggs are not laid at once. The average egg-laying period is about seven days and the maximum is about 14 days. Some insects start egg-laying early and some a few days later and so swarming lasts usually from three to four weeks.

12. *Brood lac and Phunki lac.*—Mature lac containing the young lac larvæ ready to swarm is usually spoken of as *brood lac*. When all the larvæ have swarmed out from the brood lac, leaving the encrustation empty of lac larvæ, it is called *phunki lac*.

13. *Stick lac, seed lac.*—*Stick lac* is the term used when the lac is on the stick, but when it has been scraped from the stick, it is known as " scraped lac ". Scraped lac, if ground and washed, yields the " seed lac " of commerce.

14. *Infection or Inoculation.*—Infection or inoculation is the process of tying *brood lac* to the branches of a tree on which it is proposed to grow lac. This is usually done some days before the emergence of the larvæ or when they have actually begun to swarm. The emerging larvæ walk directly from the brood sticks on to their new home.

15. *Lac insects and suitable host trees.*—There are several strains of lac insects and each strain has its own favourite host plant on which it thrives for generations without deterioration. These broods are named after the host on which they flourish best. The insect which thrives on *Kusum* (*Schleichera trijuga*) is commonly known as *Kusum* brood. (*Laccifer lacca* Kerr). The species which grows best on *Shorea talura* is the Mysore strain, commonly called the *Shorea* brood (*Tachardia lacca*). The Kusum brood will not grow to maturity on *Shorea talura*, nor will the *Shorea* brood take on Kusum.

The Kusum brood takes extremely well on *Acacia catechu* (Khair) which is an equally suitable host for use in alternation with Kusum, if available. Kusum brood can be put on to *Zizyphus jujuba* (ber) for the rains crop, but no alternation has however proved successful as has been done with khair.

The Shorea insect is the smallest but the most prolific of the lac insects, being the only trivoltine (with three broods in a year) species known.

16. *Life cycle and crop periods.*—The life cycle of the lac insect on Kusum for both crops in a year is one of six months in North India, which is not the case at Vannathiparai where it has actually taken only 5 months 10 days to 5 months 26 days. The two crops are known locally as the Summer and the Rains crop.

In North Salem it takes 13-14 months for the insect to complete three life cycles, i.e., to raise three successive lac crops. These are generally termed the pre-monsoon, monsoon, and post-monsoon crops. The pre-monsoon crop takes the least time (15 weeks) to mature, the monsoon crop takes 19 weeks and the post-monsoon crop covers the longest period, 23 to 25 weeks, as it passes through the cold season.

The number as well as the period of the different life cycles of lac crops is largely dependent on the climatic conditions prevailing in a locality. The Salem *Shorea* brood when tried at the Indian Lac Research Institute, Ranchi, did not go through three cycles in 13 months, but produced only two crops in a year.

17. *Signs of crop maturity and forecast of emergence.*—It is stated in books on Lac Cultivation that swarming usually occurs at approximately the same time each year, but at Vannathiparai the actual starting date of swarming has been found advancing up to a month from one year to the next. Where such variations occur the judgment of the state of maturity of the lac crop and of the date of emergence of larvæ is a matter of great importance. Otherwise there may be premature cutting of brood lac, which is extremely harmful as it weakens the vitality of the mother and its brood by cutting off their food supply, or the cutting of brood lac may be delayed too long, not leaving sufficient time to cut the crop and infect the new trees before swarming starts. Early cutting as well as late cutting of brood lac is therefore detrimental. Lac to be used as brood should be cut just so long before swarming as to allow sufficient time for the cutting and inoculating processes.

18. Methods of determination of crop maturity are :—

(i) If a female cell is crushed between the fingers, the developing embryos in the ovary look granular about 3–4 weeks before swarming, in the summer (Jethwi) crop and 5–6 weeks before in the rains crop (Aghani). The embryos become more and more prominent up to the time of swarming.

(ii) The encrustation begins to crack about 2–3 weeks before swarming in the summer and about 4–5 weeks in the rains crop.

(iii) The encrustation has a drier appearance about 2 weeks before swarming is due, and can be peeled off from the host twig with greater ease.

(iv) Appearance of an yellow orange spot on the female cells due to muscular contraction of the female lac insects at the time of egg-laying. This is dealt with below.

19. *Forecast of emergence of lac larvæ.*—The method of forecast depends on the appearance of a yellow translucent area on the lac cell, caused by the drawing away of the female insect body from the cell wall, and upon the relative size and position of this yellow area in respect of the *anal tubercular* and *brachial* openings of the lac cell.

A small deep yellow spot appears at the base of the anal tubercular opening in mature cells because the body of the female insect, which is dark crimson in color, is slightly drawn apart from the translucent orange lac cell in that region. As the time for egg-laying approaches the insect contracts its muscles and the body is drawn away from the cell wall. The cavity thus formed within the cell shows itself outside as the yellow spot which actually is the colour of the cell wall at this vacant place. Muscles continue contracting and the female ultimately becomes a lining to the anterior half of its test. Simultaneously the small light yellow spot increases and assumes a big size and deepens in colour.

The cavity formed within the cell by the contraction of the female insect acts as an incubating chamber into which the eggs are deposited and within which they hatch. Emergence from the incubating chamber takes place by way of the anal tubercular opening of the lac cell from which the anal tubercle is withdrawn during the process of contraction of the female body.

The light yellow spot appears about 5–8 days prior to the date of swarming in the summer crop and 12 to 20 (occasionally 30 days) in the rains crop (Aghani).

When the light yellow spot reaches the anal tubercular opening, swarming will start in 3–6 days, provided the climatic conditions do not become adverse and the dry temperature does not fall below 20°C (68°F).

In general, swarming actually begins when the yellow area has become almost a straight line on both sides of the cell and has reached half way between the brachial pores and the anal tubercle. It actually begins within 24 hours after the anal tubercle has been completely withdrawn within the test, and generally ceases when the yellow area has reached or is slightly anterior to the brachial pores on either side.

Isolated or less coalesced healthy cells should be selected for observing the yellow area to forecast the date of emergence. The posterior portions of these tests (the part of the test lower to the anal tubercular opening) should be cleaned of dust or fungus by a gentle rub of a finger and the yellow spot looked for immediately below the anal tubercular opening.

Certain cells which are parasitised or dead or unhealthy show yellow spots resembling those specified for the forecast of emergence. It is therefore necessary that some cells after observation should be crushed and examined to test whether they are healthy. If the anal tubercle of healthy insects is touched with a pin, the touch will bring out at the top of the tube a drop of liquid excreta called ' honey dew.'

20. *Oviposition.*—Oviposition (egg-laying), incubation and swarming of larvæ are governed by the temperature occurring at these periods and are unaffected by humidity as will be seen from the following statements based on the publications of the Indian Lac Research Institute, Ranchi.

Egg-laying will begin if the temperature is above 17° C (62°. 6 F) in summer, and above 15° C (59° F) in winter. Female cells subjected to a temperature lower than 17° C in summer and 15° C in winter retain their egg-laying vitality for 3 to 12 days however, depending on the delivery stage at the time of subjection to lowered temperature and the season. The yield of lac and the sex-ratio in the progeny is not adversely affected as the result of subjection of the mother to a lower temperature.

The average egg-laying period for a single cell is seven days and the maximum is about 14 days. The rate of egg-laying is at a maximum between the second and sixth day of her egg-laying period.

21. *Incubation.*—The incubation period in all seasons varied from 45 minutes to 1 hour 30 minutes. It varies directly with the temperature at the time of incubation, being least in June and greatest in December.

Larvæ are inactive below a temparature of 20°–22° C (68°–71°.6 F). If the larvæ after emerging from the egg remain in the incubating chamber of the female cell for 4–5 days they die of starvation. If the atmospheric temperature during the oviposition period is unfavourable to oviposition and emergence, i.e., below 18°–20° C (64°–68° F) emergence of larvæ from the cells will be naturally delayed.

The mother lac insect does not die until practically all the living larvæ have passed out from her ovaries into the incubating chamber. She can control the emergence to some extent at the time of adverse climatic conditions.

22. *Emergence.*—The maximum swarming period for a single female is 11 days in June and 16 in November, and the average 6 and 7 days, respectively. The largest number of larvæ swarming on a single day emerge between the first and the fifth day of the swarming period.

Swarming from all cells on a twig does not start simultaneously. It usually starts in a few cells, becomes general a few days later and gradually subsides. In two weeks, however, the greater part of the emergence has occurred from all cells and after three weeks, emergence has generally ceased. Thus after 2–3 weeks the brood is no longer of any value as brood.

The swarming in a locality is stated to be regular almost within a few days but the weather conditions during the season tend to delay or accelerate it. A running record of the swarming dates for each locality should be maintained. At Vannathiparai the swarming dates have advanced from crop to crop, and the infection which was done on the 20th January 1932 was done this year on 17th November 1934. It has advanced by nearly 2 months in the course of 6 crops.

Both male and female larvæ emerge mixed up together. The view that mostly females emerge first and males later has been shown to be incorrect.

23. *Fertility.*—Fertility, i.e., the number of larvæ produced by a female lac insect, is probably dependent upon the temperature during the period of maturation of the ovaries.

The fertility of various broods was calculated at the Institute at the crop seasons. The figures for the Kusum brood show that the number of young ones produced by a female varied from 332 to 618.

24. *Sex ratio.*—The ratio between the two sexes is of great economic importance. The male insect secretes very little lac. It comes out from its lac cell very early and when it has performed its function of fertilization, it dies. The greater part of the lac is secreted by the females mostly after their fertilization. This means that sufficient males should be present in a normal crop to ensure that the process of fertilization is satisfactorily carried out. On the other hand a preponderance of males will mean a poor lac encrustation, i.e., a poor crop.

25. *Parthenogenesis.*—It would appear, however, that fertilization is non-essential to the development of the female insects and that asexual reproduction can occur to the seventh generation at least, without adversely affecting the fertility or resin secretion efficiency of the female lac insect or altering the sex ratio of her progeny.

Male cells were picked out from an experimental brood and the female cells reproduced parthenogenetically. In successive progenies of this brood the males were again eliminated and normal sexual reproduction effective y prevented. Seven successful generations were thus produced asexually, and the experiment is in progress.

Results obtained so far show that the development and fertility of asexually produced female cells is not inferior to that of the sexually produced female cells, and the ratio of males to females in their progeny is quite normal. It seems therefore that the presence of males is not essential to the development and swarm production of the females, and that their elimination would in no way be detrimental to the progress of lac cultivation. Factors causing heavy male mortality will not therefore adversely affect the yield or production of brood. As the resin secreted by the male is negligible the absence of males from a swarm would probably be an advantage in that all available shoots will be colonized by females and the risk of the occurrence of a predominently male brood would be eliminated.

26. *Enemies and friends of lac.*—Lac has a large number of enemies which cause very considerable annual loss to the cultivator. The damage done to lac crops by these pests is enormous. On an average about a third of the potential crop is actually produced and the other two-third is destroyed annually. The most important and injurious of these enemies

are themselves insects about whom little was known till recently. Birds, rats, squirrels and monkeys occassionally do some damage but the damage done by them is really negligible when compared with that done by insects.

27. The recognition of the insect enemies of lac and a full knowledge of their life histories and of the measures necessary to control their activities are matters of extreme importance to every cultivator of lac. Without this knowledge no successful attempt can be made to get rid of these enemies which seem to co-exist with lac and go with it even to distant localities where lac cultivation is newly introduced. Since the establishment of the Indian Lac Research Institute, Namkum, much useful research in this field has been done and the life histories of the most important and injurious of these enemies have been investigated one after another and methods of control evolved. It is essential for those who are engaged in lac cultivation to thoroughly acquaint themselves with all the up-to-date information available on this matter in the reports and bulletins published by the Indian Lac Research Institute. To effectively protect a crop from the likely sources of damage and destruction is as vital a matter as the knowledge to grow it successfully. This is the reason for giving below a detailed account of the life histories of the important pests.

28. The insect enemies of lac fall into two main groups, the *predators* and the *parasites*. The predators are insects which attack the lac insect from the outside of the cell or encrustation. They lay their eggs on or by the lac encrustation, and the newly hatched larva begins to feed on the lac insects. It may continue to feed from the surface or it may eat its way into the encrustation until it is completely hidden in the tunnel which it has bored into the lac. It never inhabits one single lac cell. Finally it pupates and the moth emerges to fly away and lay its eggs on other lac encrustations.

29. The parasites are all small insects that usually make their attack from the inside of the lac cell. The female parasite lays her eggs on or in the body of the lac insect, through the anal hole of the lac cell. The larvæ hatch out and live on the surface of the lac insect or actually within its body, feeding on it. The lac insect becomes the host of the parasites. Finally the grub pupates within the lac cell and the insect emerges ready to fly away and repeat this process.

30. *Control of lac enemies.*—Control measures which can be utilized against the insect enemies of the lac insect fall into two groups :—

(i) Artificial control.

(ii) Biological or natural control.

31. (*i*) *Artificial control.*—Artificial control applies alike to the predator and the parasite enemies of the lac insect. Control methods besides being inexpensive (which is most important) must also be easily intelligible to the ordinary workmen who have to effectively apply them. As the lac hosts are usually big trees, control measures like spraying, which are possible in the case of small trees in plantations, may prove impracticable or too expensive if the big trees are scattered over a wide area. Control therefore must be applied at the time when the crop is being cut or immediately after cropping and before starting the next crop.

32. The control measures recommended for adoption are all extremely simple and cost little or nothing. Their general use would go a long way towards reducing to a minimum the very large damage done by lac enemies.

(1) Lac should never be left on the trees, even if the price be low and it does not pay to cut it.

(2) Natural infection, i.e., self-inoculation, must not be allowed. The practice of leaving the whole or a portion of the lac on the tree to reinfect it should be avoided because, after the lac larvæ have swarmed, parasite and predator enemies of lac go on emerging from the old lac and infect the new crop.

(3) Brood lac for infection purposes should be cut as near to the time of swarming as possible, never more than a week before, for optimum results. As the swarming periods are sometimes affected by climatic conditions, it would be better to wait until the first larvæ are seen and then to cut the crop.

(4) Healthy, pest-free brood lac should be used for infection. This should be chosen carefully, and no enemy-infected sticks should be used for this purpose.

(5) All brood lac from the infected trees should be removed 2–3 weeks after the date of commencement of swarming. The reason for this is the same as given for (2). It is preferable to remove it sooner if the trees are sufficiently covered with the larvæ. Two weeks in most cases is quite ample for thorough infection of the host trees.

(6) Lac not required as brood may be cut from the tree about a week before swarming.

(7) Stick lac should be converted into scraped and seed lac as early as possible. All harvested lac not required as brood, and all brood lac after use, should be immediately scraped from the sticks and if possible ground and washed. When scraping the lac the larvæ and pupa of the predators which are seen should be killed.

33. When there is shortage of labour and lac has to be stored for some time, the following procedure may be adopted :—

(*a*) *Fumigation.*—Stick lac or scraped lac is enclosed in a chamber and fumigated with Carbon bisulphide at the rate of 1 oz. to 10 cubic feet of space, the object being to exterminate the enemies which remain in the lac after it has been cut, or

(*b*) *Water immersion.*—*Ari* or Phunki lac should be immersed in water for 8–12 days and then dried preferably in shade. This method is at present not recommended for general use but only as a special one for adoption on occasions. Though it ensures complete pest mortality, the lac is sometimes adversely affected as a raw product for the manufacture of shellac.

34. Methods recommended in control (7) are particularly important when the fresh cut crop is stored in open godowns in close vicinity to the cropping area. These, if carried out systematically, would in a short time not only reduce the damage by pests to future lac crops but also prevent the depreciation in stored lac due to the feeding of the larvæ of *Eublemma* and *Holcocera* on the lac.

35. Spraying has definitely been abandoned as a control measure against lac enemies. In every case where it was tried it caused heavy mortality in lac insects with no diminution in the incidence of parasites and predators. Sprays tried were of Lead arsenate, nicotin, soap and salt solutions.

36. (*ii*) *Biological or natural control.*—Biological control is based on the fact that the majority of the predators and parasites of lac have in nature their own insect enemies which attack and destroy them. These are sometimes styled as ‘ friends ’ of the lac insect. These beneficial or partly beneficial insects are the predators, parasites or hyper-parasites of lac enemies and under natural conditions act as a check on the increase of the injurious species. They belong to the groups *Pyralidœ*, *Chalcidoidœ*, *Formicidœ*, *Ichneumonidœ*, *Bethylidaœ* and *Braconidœ*. The most important are mentioned under each class of pests. Investigations made so far by the Indian Lac Research Institute show that the biological control of the predators is a possibility but that of the parasites is at present out of the question.

37. *Predators.*—Among the predator enemies of the lac insect there are two of extreme importance and one of minor importance. The two main predators are *Eublemma amabilis* and *Holcocera pulverea*, and the minor one is *Chrysopa sp.* The first two predators do more harm than all the other predators and parasites of lac put together.

Eublemma and *Holcocera* are both moths whose larval and pupal stages are found connected with lac ; *Chrysopa sp.* is a green fly whose larvæ alone injure the lac insect.

38. *Eublemma amabilis.*—Of the two moths, *Eublemma* is undoubtedly the more important as it is widely distributed and does more damage than any other single enemy of lac. The damage done by it is enormous in practically every lac growing area in India. Its larva not only destroys the lac insect but also eats the lac encrustation. It is responsible for at least 30 per cent of the crop damage.

In every case the young lac crop is mainly infected by moths emerging from the previous crop after it has been cut and while being used as brood lac or when stored in the vicinity as stick lac.

39. *Life history.*—The moth lays its eggs on or by the lac encrustation. The tiny larva hatches out and begins to eat its way into the encrustation, making a tunnel for itself, until it comes to lie entirely concealed inside. Here it lives and grows, increasing the size of its tunnel by feeding on the adjoining lac cells. A single larva damages from 40–45 mature cells prior to pupation. The body of the larva is creamy white with a pinkish tinge and its head is dark brown. The larva is fairly inactive in its movements. After a time it becomes full grown and pupates. The larval period varies according to the season of the year from 15 to 30 days from April to September and from one to four months from October to March. The larva hibernates during the cold season, November to February, in North India.

The pupa is at first pale yellow in color, all parts except the abdomen turning deep brown when the moth is about to emerge. The pupa lies in its larval tunnel lined with silk threads interspersed with its excreta, and with a circular opening at one end of the tunnel.

This hole is cut prior to pupation and is lined from below with a silken covering which is ruptured by the *imago* while emerging. The length of the pupal stage also varies according to the seasons, 8–12 days from June to September and 12 to 20 days in other months. The moth emerges through a rupture in the pupal coat. The color of the moth is creamy white tinged with bluish or greenish markings dorsally. Its life varies from 3–4 weeks in January to just a day in June.

As soon as the moths emerge they seek shelter till dusk on the lower parts of the leaves of the host plant or in a shady place in the vicinity after which they presumably fly about in search of mates, during the night.

The eggs are laid soon after copulation, for a period of 1—10 days. Eggs are laid singly as well as in groups of 2 to 40. Moths are more fertile during July-October as they lay a much larger number of eggs during this period than in the other months of the year.

The duration of hatching rises continuously from November to February (1 to 30 days in generation 3), and begins to drop from March to June (1 to 4 days in generations 4 to 5), and remains more or less at its lowest from June to October (6 hours to 2–3 days in generations 6, 1 and 2). The mortality of eggs laid from November-February, and from May to the first half of June is much greater than in any other generation. This can only be accounted for by cold and heat.

40. *Life Cycles.*—Investigation has shown that *Eublemma* has 6 life cycles in a little over a year. Eggs laid in the middle of July emerge as moths towards the end of August. This is the first cycle. Eggs laid by these moths become adults only in October, forming the second cycle. Of the eggs laid by these moths some mature in November, while others remain as caterpillars and hibernate. Moths from these latter emerge in December-January, or in January-February. This is the third cycle, and moths from this generation emerge over a long period, from November to February. Most of the eggs laid by this third generation moths fail to develop ; those that do, develop in March and May constituting the fourth cycle. These moths lay eggs and the adults emerge in early June, giving the fifth cycle. These moths lay eggs and the adults emerge in late July and early August. This is the sixth cycle, completing the generations that mature during a year.

41. *Controls.*—*Eublemma amabilis* has its own predators and parasites which feed on its larvæ and pupa.

(1) The big black ant, *Camponotus compressus*, and the common little red ant, *Solenopsis geminata rufa* attack and kill *Eublemma* larvæ when they are exposed (newly hatched from the egg before they enter the encrustation).

(2) The larva of another moth, *Ephestia sp.*, found on lac attack and kill the larva of *Eublemma* if it meets it.

(3) *Eublemma* has also a number of enemy parasites. These lay their eggs in or on the caterpillar and the young grubs grow, use it as food, and finally kill it. There are 6 such enemies, the more important being :—*Bracon tachardiæ*, *Brachymeria tachardiæ* and the *Black Chalcid.*

42. *Holcocera pulverea.*—This moth is a lac enemy of the same type as *Eublemma.* It is widely distributed all over India and may be said to be as cosmopolitan, in all lac growing districts, as *Eublemma.* It also causes considerable damage to lac crops and is therefore a serious pest but not to the same extent as *Eublemma.* Its larvæ do more damage to *stored lac* than to the lac crop on the trees.

43. *Life history.*—" Eggs are laid singly either between the lac cells, or in the anal opening of the test of the female lac insects, or in the empty tests of the male lac insects through the Opercular opening. They may also be found on twigs which are not lac encrusted more often on those portions which are covered by the saprophytic black fungus commonly found associated with lac infected trees, which grows on the honey dew secreted by the lac insects.

" The larva escapes from the egg by biting a longitudinal slit. It enters the lac encrustation usually by biting a hole at the base of a lac cell, but may enter via the anal tubercular orifice or the brachial pores of a lac test. The larva then tunnels into the encrustation feeding on the lac insects and their tests. It also feeds on dead lac insects and on the encrustation. The larva leaves, as it feeds, a tough web of silken threads interwoven with pieces of encrustation and excreta. An individual larva is capable of damaging 7–45 mature female insects or about 64—449 immature ones.

The larva then becomes inactive and spins a white tough cocoon within its gallery in which it pupates. It is of deep chocolate colour and very active. The larva pupates within the lac and the pupa is of a deep rich brown colour.

The maximum average monthly longevity of females to the nearest day was 15 days in December and the minimum, 5 days in May; the corresponding figures for the male are 19 days in December and 5 days in May. Mating has not been observed and probably occurs only at night.

Holcocera is less fertile than *Eublemma*. The damage done by larvæ of *Holcocera pulverea* to the lac crop in the field is considerably less than that done by larvæ of *Eublemma amabilis*. *Holcocera* larvæ, however, do more damage to stored lac than those of *Eublemma*.

The Katki and Aghani crops are more affected than the Baisakhi and Jethwi, both in the field and in the store.

44. *Generations*.—There are five generations in a year and not six as was previously believed, the first being over the period of July-September. The second is complex: part of the eggs laid in September give rise to adults in October-November, and part hibernate in larval and pupal stages and emerge during the following months up to April, mainly in March. Most of the eggs laid by the second generation fail to survive due to cold; those that do, give rise to adults in March-April. This is the third generation. The fourth generation emerges in May-June. Eggs laid by the fourth generation adults in early June usually fail to survive the heat. Those laid in late June and survivors of the early June eggs emerge as adults in July-August from the lac, mainly after cutting. The fifth generation is therefore double to a certain extent."

The *Holcocera* emergence is at its highest in October-November, March-April and July-August, when the emergence of *Eublemma* is also high.

45. *Control measures*.—Control methods are similar to those described for *Eublemma*. It has, like *Eublemma*, a number of natural enemies. Its larvæ and pupa are destroyed by the ants, *Camponotus compressus* and *Solenopsis geminata rufa*. It has also a series of parasite enemies among *Chalcids*, *Ichneumonids* and *Bethylids*. Biological control of *Holcocera pulverea* by means of *A. Tachardiæ* or *P. testaceicollis* is a possibility.

46. *Chrysopa sp*.—The adult is a large green fly with golden eyes and broad transparent wings which are net veined. It lays its eggs singly, on the lac encrustation or on the upper surface of leaves and twigs of infected trees, each on a thin hairy pedestal. The larva hatches out, climbs down the pedestal and begins to feed. The small larva conceals itself by covering its back with bits of bark, leaves and waxy filaments which are held in position by hooked hairs. It is fairly active and moves about on the encrustation, driving its long mouth parts into a lac cell through the anal opening and sucking the body contents of the lac insect. It also attacks crawling male lac insects. The larva pupates in a small circular white cocoon on the surface of the lac encrustation from which finally the fly emerges.

Chrysopa cocoons are parasitised by *Ichneumonids*. Spraying the lac with 2 to 4 per cent phenyle will be found useful.

47. *Parasites*.—The second group of lac enemies are the parasites. These are all very small insects the larval and pupal stages of which are associated with the lac insect within the lac cell.

48. The actual damage done by them, though considerably less serious than that done by either *Eublemma* or *Holcocera*, is nevertheless of economic importance. With a view to ascertain the extent of damage done by parasitism a close study of the damage done by *Chalcidoid* parasites during each month of a year was made at the Indian Lac Research Institute. Results of monthly examinations made throughout the year 1932–33 were recorded in the form of percentage of parasitised cells in the total number of cells examined. The average percentage parasitism for the year was 7·4 per cent. The percentage was calculated on an examination of over a lakh of cells. Thus the damage done by parasites, though important, is small compared to that done by predator enemies of lac.

49. From each crop there is an enormous emergence of parasites at the time of, and shortly after, crop cutting and emergence of the lac larvæ. It is this emergence of parasites which affects the new crop. The parasite emergence is at its height in October-November and continues into December.

50. The important parasites are :—

Tetrastichus purpurens; *Brasema annulicandis*; *Coccophagus tschirchii*; *Tachardiæphagus tachardiæ*; *Black Chalcid, Spotted chalcid*; *Yellow Chalcid*.

51. Several of these are suspected of parasitising insects other than lac also. At times they completely disappear from lac, to reappear in the crop again some months later. During these intervals they live as parasites of some other insects. Where this is the case,

destruction of these other or alternative hosts affords one possible method of control. The alternative host forms a refuge for it at times when the lac is too immature or in seasons when lac cultivation is for some reason or other suspended.

52. Control methods for parasites are difficult. Biological control of lac parasites is at present out of the question. The position of the parasite within the lac cell renders internal poisons more or less useless and contact poisons which might be used would also kill the lac insect. Water immersion or fumigation of stored and used brood lac will be found helpful.

53. *Ants.*—On most lac bearing trees many species of ants will be seen walking over the encrustation stopping every now and then and licking at the lac. Investigation has shown that the majority of ants associated with lac are harmless and that some are definitely beneficial.

54. Ants visit lac in order to lick up the 'honey dew' secreted by the lac insect. This in itself is beneficial as the 'honey dew,' if allowed to flow freely, might, mixed with dust, block up the breathing holes of the lac insect and suffocate it.

The only apparent injury the ant does to the lac insect is that while walking about on the lac encrustation it breaks off the waxy white filaments, the profuse growth of which is a good sign of a healthy lac insect. So on trees infected with ants the waxy white filaments seldom grow long.

55. Some ants kill and feed on the larvæ of the predators, *Eublemma* and *Holcocera* and also on *Chalcid* parasite grubs if they are exposed. *Camponotus compressus*, the common big black ant and *Solenopsis geminata rufa*, the common little red ant, are among these. There are also some species of ants, which during times of swarming and male emergence, pick up the crawling larvae and the male insects in their jaws and carry them away. *Solenopsis geminata rufa* and *Iridiomyrmex anceps* belong to this class but the red forest ant is not one of them.

56. Ants as a whole can be classed as lac friends. Should ants that pick up the lac larvae or male insects invade the farm a simple control may be used. The foot of the infected tree may be painted with cheap molasses or straw may be spread round the base of the trunk well covered with molasses. This control need only be utilized at the time of larval and male emergence.

Ant's nests and formicaries may be destroyed by pouring hot 10 per cent phenyle into them or they may be fumigated.

57. *Coleoptera.*—The beetle larvae and adults occuring in lac are to be regarded as scavengers as they do not bite through the encrustation and therefore are not to be regarded as enemies. They feed on the dead bodies of the lac insects. Those commonly observed are :—

Silvanopsis sp., Tribolium sp. and Dermestid sp.

58. *Rats.*—In Salem and Coimbatore rats have caused damage to lac crops approaching maturity. They do not appear to eat the lac or the lac insect but simply bite off the encrustation on the shoots. In one crop the damage was so great that within a week the encrustation on 60 trees was completely stripped. The attack was not only unexpected but was on a mass scale and the damage was so rapidly done that in a few days the whole crop was lost.

Tying of thorns round the boles of trees was first tried but proved ineffectual. Then poisoned baits, made of *Barium carbonate* and ragi flour, were resorted to which proved successful. But objection was raised to this method lest the poisoned baits should result in cattle and cattle-boys getting poisoned. Finally the use of rat traps was recommended. A rat trap costs about half a rupee and can be used for a number of years. This method is recommended as it is much safer, simpler and ultimately less costly than the methods mentioned above.

59. Birds may pick up the larvæ or male insects during their swarming and damage the young larvæ soon after settlement by alighting on the infected shoots.

60. Squirrels occasionally break off the encrustation while running about on the branches. To prevent damage from this source tying of sharp thorns round the boles of infected trees is suggested.

61. Monkeys sometimes strip the encrustation from the shoots or push down the brood-sticks put on trees for infection purposes. Some form of scare worked by wind or men may be used if the damage is serious.

SECTION 2.—A BRIEF SURVEY OF THE LAC INDUSTRY.

62. A knowledge of the lac industry is necessary in order to market lac products to the best advantage : a brief survey is therfore given below :—

63. *Lac producing countries.*—India is not only the biggest producer of lac but is also the sole supplier of shellac and seed lac to the world. Indo-China and Siam also grow lac but their annual export of stick lac from Singapore and Bangkok is not considerable.

In India, the Province of Bihar and Orissa, together with the Central Provinces, forms the main lac growing tract. Burma, Assam, Sindh and the United Provinces also produce lac in large quantities. In South India, lac is grown in a few localities in Mysore, Jeypore, Salem and Madura.

64. *Lac products and output.*—Lac was first sought after for dyeing silk when the price of 'cochineal' rose high. In the beginning of the last century the resin (seed lac) was not utilized commercially and was considered to be a waste product in much the same light as lac dye has come to be considered now-a-days. Lac dye was exported in large quantities, and the maximum was reached in 1826, when 760,729 lb. were exported. The export, however, declined rapidly and became practically extinct by 1897. In 1903 the total quantity of lac dye exported was only one ton.

Simultaneously with this decrease, the export of lac resin in the form of shellac has been increasing continuously. On an average 500,000 maunds (1 maund is equal to 82 lb.) of shellac worth over five hundred lakhs of rupees came to be exported annually in the first quarter of this century. In recent years there has been an increasing export of seed lac from India, partly for manufacture of bleached lacs and partly for making shellacs, the latter being due to dissatisfaction with Indian manufacturing methods. No statistics are available for internal consumption. If, to the large exports, the internal consumption (which is by no means small) is added, it would be safe to reckon the total production of stick lac in India to be in the neighbourhood of 60 million pounds.

65. *Exports of Lac Products.*—In spite of the general trade depression and the increasing production of synthetic resins in America and Europe, the exports of shellac and seed lac have been fairly normal. This is mainly due to the low level at which prices have remained in the past few years, as the following export figure will show :—

Year.	Seed lac exported.			Shellac exported.		
	Quantity in maunds.	Value in rupees.	price per maund.	Quantity in maunds.	Value in rupees.	Price per maund.
			RS.			RS.
1928–29	126,232	1,00,51,046	80	724,880	6,81,61,168	94
1929–30	92,923	68,52,475	74	680,539	5,67,95,600	83
1930–31	145,175	57,61,593	40	500,475	2,28,64,800	46
1931–32	142,946	37,49,603	26	405,675	1,29,84,586	32
1932–33	165,025	31,86,213	19	357,489	83,38,484	23
1933–34	207,902	41,64,710	20	722,638	1,94,24,939	27

66. *Use of lac.*—Lac is used in a large number of trades, the principal ones in the order of importance being,

(1) The Gramophone disc-record industry. (This industry consumes about 50 per cent of the annual production of lac.)

(2) The spirit-varnish trades, electrical paint and varnish, and general. (These industries account for 35 per cent.)

(3) The felt and hard hat and crape industries. (These take about 5 per cent.)

(4) Miscellaneous industries, among which may be mentioned : Sealing Wax, leather finishing, Rubber finishing, Paper finishing, Tinfoil finish, Photographic work, Medicinal uses, Bloom on Chocolates, Coffee beans, Pyrotechnics and so forth. (These account for 10 per cent.)

In India, lac products are widely used for the making of bangles, bracelets, for filling ornaments and jewels, in the ornamentation of ivory, metal ware and toys and in Indian medicine.

67. *Synthetic Resins.*—It was during the war that the scientist first turned his attention to the production of synthetic resins in consequence of shortage of lac products. A further impetus was given to the production of synthetic substances when the price of lac became excessive. With high prices, the attention of the consumers also was directed to the finding out of cheap substitutes and innumerable attempts were made to produce them. The reasonably stable price, with absolute purity and uniform quality of the synthetic product,

appealed to the modern manufacturers who naturally preferred to use them in place of lac. Any number of lac substitutes are now in the market, principally resins of phenol and formaldehyde, casein products, the nitro-cellulose and cellulose acetate products, and so forth. These have proved of immense value in the preparation of insulating varnishes and have permanently displaced lac in the plastics and varnish trade.

These synthetic substances are being largely produced in the United States, Germany, France and the United Kingdom which are also the biggest consumers of lac products.

68. *The Gramophone Record Industry.*—But so far no synthetic lac has been prepared or discovered to displace natural lac in the gramophone industry, an industry of no mean magnitude. Here, lac is firmly established due to its inherent qualities of " Life " and " Flow " which the synthetics so far have failed to reproduce. Lac has a long ' life ' and does not get rubbery or amorphous rapidly. A lac record rejected for technical faults, as also all the trimmings when making the blank discs, can be reground and remelted for use again. But a synthetic resin once fused remains fused for good and all. Besides lac gives a polish and hardness of film to records which puts them in a class by themselves.

Half the lac products exported from India are now utilised by the gramophone industry and a failure in this demand, such as might result from the use of a new method of sound reproduction or new substances for the construction of gramophone records, would indeed be serious.

69. *New uses for lac.*—On the other hand intensive research in synthetic materials has evolved new methods whereby the natural lac can be treated to produce substances of greater value, and have very largely helped in improving the possible uses of the natural product. The incorporation of bleached lac in cellulose lacquers, to give better adhesion and ' body,' is a new use for this material. Abnormally low prices may actually re-establish the use of lac in some industries which had been captured by the synthetics and make it available for certain processes for which it is eminently suitable but hitherto too dear.

The finding of new uses for lac products has been receiving active consideration and research in the Indian Lac Research Institute, Ranchi (Bihar).

70. *Future of Lac Industry.*—There is an element of uncertainty in the whole business which has been more or less of a speculative nature. But with all the uncertainties of a precarious crop, violent fluctuation in prices and an uncertain and unstable market, the industry has been able to pull through and hold its own. There have been times of extreme depression as well as of inflation but in spite of all these the industry has continued to exist. What its future will be is difficult to prophesy.

Synthetic resins are undoubtedly making steady inroads into the field of lac utilisation. Other factors, particularly those affecting the gramophone industry, may become pressing as time goes on, but it is impossible to foresee the period of their advent with any certainty. In spite of the general trade depression and the increasing production of synthetic resins and displacement in certain trades, natural lac products have held their own due to the cheapness of lac now and for some time past. Most of the substitutes passed into the background when the price of lac fell to low levels. So the most determining factor in the future welfare of lac will undoubtedly be its price. If lac is to continue as a widely used resin it must be a cheap resin. Substitutes have fixed the limits of cost of materials in the trades. Consequently lac rules only while prices are competitive.

The production of the cleanest seed lac would give the greatest satisfaction to users of seed lac in foreign countries where ingrained pieces of lac dye in it present serious technical difficulties. A pure lac at a reasonable price will always command a ready market.

The future for natural lac, if low priced and pure, seems full of hope. It only requires some propaganda not only to safeguard lac in its present uses but to extend its use into fields which new industries are opening out and in which it has not obtained a footing because of its qualities not being properly known and appreciated. The Indian Lac Research Institute can be relied upon to carry on such propaganda in India and in foreign countries.

The export figure show that, in spite of the recent extremely low prices, supplies of raw or manufactured material have not fallen off. It would appear therefore that cultivators and manufacturers find it possible to continue the production of stick lac and shellac although the prices obtained for them have been low. The possibility of maintenance of supplies of lac products at the recent low rates justifies the policy of concentrating on the production of lac.

71. *Agency of production.*—There is an impression that the object of the newly started lac cultivation is to make it a village industry in Madras. This idea seems to be based on the analogy of lac producing areas in Bihar and Central India. There large numbers of host trees on which lac is grown are found outside the reserves and the people know how to

cultivate lac. There are also a large number of small and big lac factories situated in those lac producing tracts, which purchase the raw produce from the cultivator and manufacture it into shellac. But conditions are just the reverse in the Madras Presidency, where lac hosts are mostly found in the reserves and the people are ingorant of the methods of producing and manufacturing lac. Contract agency was found unsuitable for this operation in Central India and has been replaced by departmental working. So lac cultivation in the Madras forests will have to be a departmental operation carried out by the District Staff as in the other lac producing provinces.*

72. *Disposal of lac.*—Lac may be disposed of as scraped lac, seed lac or dust lac.

Messrs. J. Thomas and Company who have been selling our lac in Calcutta, were asked if they could sell a thousand maunds a year. The firm replied as follows : "We can at once assure you that you would have no difficulty in selling a thousand maunds of Kusmi seed lac or more during the course of one year as the yearly demand for this grade is roughly 50,000 maunds."

All the seed lac can therefore be sold in the Calcutta market. Further, there is an increasing export of seed lac from India. The cleanest seed lac, free from water-soluble products such as lac dye and other adulterants, will always find a ready market. Its purity and standard quality will be its greatest attraction to users of seed lac in this as well as in foreign countries where ingrained pieces of lac dye, etc., in the seed lac present serious technical difficulties in its conversion to shellac. The increasing exports of seed lac to foreign countries particularly to the United Kingdom, Germany and the United States of America, are partly for the manufacture of bleached lacs, and partly for making shellac, the latter being due to dissatisfaction with Indian manufacturing methods. The manufacture of shellac from seed lac in Madura district is therefore not recommended.

Kusum lac is of superior quality and is always in demand. It usually fetches a higher price than other lacs. It should therefore be sent to Calcutta for sale, normally.

The *Shorea* lac, which is of a dark brown shade, and dust lac may be disposed of locally. Requirements of the jails and the local merchants for making sealing wax and polishes, etc., will be met from these cheaper grades.

Lac dye will be required by silk dyers in Berhampur, Kumbakonam and other towns in this Presidency. Its preparation may, however, be limted to the extent of demand which has not yet been fully investigated.

73. *Markets.*—The chief market for lac in India is Calcutta which is also the chief port of export. It is practically the world's clearing house for all lac products.

The export figures given under paragraph 65 above indicate a falling demand for the manufactured article and a growing preference for seed lac.

The United States of America take roughly 50 per cent of the year's output of lac products, the United Kingdom about 25 per cent and the rest of the world, principally Germany, Japan, France, Italy and Belgium, the balance. America is the largest importer of seed lac while Germany is the second largest. The other countries which regularly take lac are : Australia, Straits Settlement, HongKong, New Zealand, Natal and South Africa in the British Empire ; China, Java, The Phillippine Islands, Egypt, Turkey, Greece Bulgaria, Portugal, Spain, Poland, Netherlands, Sweden, Norway, Denmark, Brazil, Argentine and Chile.

There exists a local demand for lac products in South India. There is little doubt of its being considerable though its full extent has not yet been investigated. A start has however been made.

The Superintendent of Prisons, Madras, who makes sealing wax for supply to the Superintendent of Stationery, has agreed to buy all his requirements of lac from the Forest Department. His orders so far have aggregated to about 5,000 lb. of seed and dust lacs. The Director of a big furniture making firm (The Standard Furniture Company Limited, Kallai) was induced to make his own wood polish by using our seed lac. He first took a maund of seed lac at Rs. 25 and within three months asked for a further supply of two maunds, agreeing to pay an enhanced rate of Rs. 30 a maund ex-depot Cumbum. Enquiries have been received from the Silk merchants at Kumbakonam asking for samples and quotations for lac and lac dye, which are receiving attention. They have been importing fairly large quantities from Burma and Mirzapur. Silk merchants at Berhampur who purchased the whole stock of lac dye from North Salem have asked for several maunds of it. There have been enquiries from Malabar and Travancore for stick lac which is used there in the preparation of Indian medicines and medicated oils. There is a large demand for making polishes and country bangles in several towns.

* There are several laterite caps on private land in Malabar where *Schleichera* grows gregariously : there is the possibility of a village industry in lac production in such localities.

The above will show that there is ample scope for developing the local sales in South India. The major part of the crop harvested in May 1935 has been sold as 'Scraped lac,' to an Indian merchant.

74. *Price.*—The prices of lac products have been subject to great fluctuations in the past. The prices of Shellac touched their lowest (Rs. 23–30 per maund) in 1914–15. By the end of that year they had gone as high as Rs. 285 per maund, when they began to decline and reached Rs. 134 in 1925. Again they rose nearly to the maximum at the end of 1927 after which they started to decline rapidly. This time they fell to the unprecedented low level of Rs. 20–23 per maund during 1932.

The price of lac was relatively steady and has remained at a very low rate (round Rs. 20–25) during the last 3 years, with the result that exports showed a considerable increase and there was reason to hope that the worst was over. But during the last year a fresh development occured, viz., the entry into the lac market of a group of London speculators which led to a rise in price. They bought a large quantity of shellac and succeeded in raising prices up to Rs. 57 per maund, with a view to their ultimate advantage. The price has fallen again to about Rs. 25 per maund (June 1935).

Kusum lac always fetches a price of some Rs. 5 per maund more than lac grown on other hosts. Our Kusum seed lac was sold during 1934 at Rs. 40–41 a maund in Calcutta and at Rs. 25–30 a maund ex-depot Cumbum. Dust lac was disposed of at Rs. 25 per maund for Madras.

As our cost of production of Kusum seed lac is about Rs. 10 a maund, there will be no difficulty in selling at a profit all the lac we can produce even if prices should go down to the 1932 level.

The possibility of the maintenance of supplies of low priced seed lac justifies, in the view of the writer, the policy of concentrating on the production of lac. The future of Kusum lac from Madura district is definitely bright.

SECTION 3.—HISTORY OF EXPERIMENTAL LAC CULTURE IN THE VANNATHIPARAI VALLEY, FROM 1930–1934.

75. *Lac host and the Locality.*—Of all the species on which lac is grown *Schleichera trijuga* (*Kusum*) is easily the best. It not only produces lac of superior quality but also gives a much higher yield per tree.

Kusum is found growing gregariously near Vannathiparai in Cumbum Range, Madura District. Over 7,000 trees exist in a compact block of about 2,000 acres. The trees are mostly large ones and appear to be in good condition as evidenced by their foliage, height growth and well developed crowns.

The altitude of this tract is about 1,500 feet. It lies at the foot of the adjoining high hills and is in plains country, accessible to carts. A perennial stream flows through it.

76. *Climate.*—The climate is equable. No official record of climatic conditions is available except for rainfall. The annual rainfall ranges from 30 to 48 inches, more than half of which falls during the North-east Monsoon. Rains occur almost every month.

The temperature recorded at Cumbum, about 10 miles from Vannathiparai, shows that this tract experiences a mild summer, the temperature ranging from 90° F. to 94° F. during March to May. The minimum recorded is 65·5° F. in January.

77. *Lac experiments—Objects defined.*—The conditions described above appeared suitable for growing lac on Kusum at Vannathiparai. But lac operations being new to this locality the local staff and labour were quite ignorant of them. Further, the raiyats (villagers) in Behar, where the cultivation of lac is an old established industry, differentiate Kusum into two types which they distinguish quite easily. One they consider a good lac host and the other not. So far it has not been possible to differentiate between them botanically.

It was therefore considered advisable that, before embarking on a regular scheme of lac cultivation, some experimental crops should be raised to test the host and the conditions of the locality. These experiments were also intended to serve the purpose of training the staff and labour in the various operations connected with lac work.

78. *Method of cultivation adopted.*—Host trees are usually pruned sometimes prior to their infection as the lac insect prefers young shoots to settle on and feed. But in parts of Bihar and in the Central Provinces, where the raiyats carry on lac cultivation, Kusum trees are not pruned preliminary to their infection when they are brought under lac cultivation for the first time. Nor do they fully infect the whole crown of a tree at first. The fact is that poor cultivators are seldom willing to invest any money on the pruning of a big tree involving a long wait of 2 to 2½ years to get the first lac crop.

In the absence of pruned trees in Vannathiparai, therefore, and to avoid delay in starting the proposed lac experiments, it was decided to try the experimental infection on unpruned trees in accordance with raiyats' methods. An inspection of the kusum area, however, revealed the existence of some kusum stumps having clumps of coppice shoots. There were also a few trees by the side of the regeneration plots which had some young shoots. These trees, and stumps with suitable shoots, were also utilized for raising the experimental crops.

79. *Preliminary Experiments.*—A start was made in January 1930 when four trees and ten stumps having coppice shoots were selected, cleaned and inoculated. All the avialable shoots on these trees were not infected but only a selected few considered suitable in each tree.

One maund of brood lac was obtained from the Chota Nagpur Lac Company, Ltd., Ranchi. It turned out to be of pcor quality and was fully infected with the larvæ of the predators of lac. Hundreds of these were picked out before tying the brood lac to the shoots. Infection was done on the 19th and 20th of January in single sticks as well as in bundles. Only a few larvæ were seen moving about on the brood lac when it was put on the branches.

While swarming and settlement were in full progress the weather changed suddenly and became extremely adverse. There was a very heavy continuous downpour of rain accompanied by a chill blast for four days. Such torrential rain and strong gale during the period of emergence caused heavy mortality among the tiny larvæ. More than 75 per cent of the larvæ were either dead or washed away. The settlement on three trees and eight clumps of coppice shoots disappeared almost completely. The crop on the other shoots survived in patches.

Whatever crop was left on the shoots became subject to damage from predators. Almost all the encrustation was tunnelled through. It was nothing but a mass of their galleries.

Cells which escaped predator attack developed fully resulting in thick encrustation on a few twigs.

The crop matured early in July and was cut on 11th July 1930. The yield was only 15 lb. This was not unexpected owing to the extremely adverse conditions during the period of swarming and subsequent development. It was decided not to utilise even a single stick of this brood lac for further inoculation. It was therefore immediately scraped, ground and washed.

The price of one maund of brood lac at Ranchi was Rs. 70 and its railway freight to Madura junction was Rs. 13. Cost of transport from Madura to Vannathiparai, bus and coolies, came to Rs. 4. Infection and crop cutting were done by the local subordinates. A sum of Rs. 3–8–0 was spent on the purchase of twine and in grinding and washing of lac.

80. The second experimental crop was also raised on a few selected unpruned trees. As on the first occasion all the shoots in these trees were not infected but only a few selected branches in each tree. Half a maund of Kusum brood lac received from the Chota Nagpur Lac., Co., Ltd., was tied to the shoots in single sticks as well as in bundles on 10th July 1930. Swarming had commenced while the brood lac was in transit. It was brisk during infection and the settlement on twigs was rapid and satisfactory. The phunki lac was removed from the trees on 25th July 1930. Male swarming occurred in September.

Later on the crop was subject to severe damage from predators. The attack was so intense that very few living cells escaped it. Almost every bit of the encrustation when scraped revealed the existence of full grown larvæ or pupæ. Even a few moths came out of the encrustation while it was being scraped.

Shoots which escaped the predator attack developed thick encrustation which again served as a good sample of the size of lac encrustation the crop can produce in this locality. Sticks with good encrustation were in no way inferior to those imported from Bihar.

The crop matured in January and was cut on 7th January 1931. One tree which was fairly isolated and had young shoots produced most of the resulting crop of 6½ lb.

The imported brood lac cost Rs. 30 at Muri (Ranchi) and its railway freight to Madura Junction was Rs. 8–2–0. Cost of transporting it to Vannathiparai was Rs. 2 and local expenses incidental to cultivation came to Rs. 10–8–0.

81. The third crop was started with 2½ lb. of local brood lac and 40 lb. of foreign brood lac imported from Bihar. The brood lac was examined for the larvæ and pupæ of predators which, as far as practicable, were removed beforehand. Infection was done in the usual way on the 20th January 1931. Swarming continued during January and

fixation was good. Males emerged from the middle of March to the 10th of April. Weather during April and May was unusually hot and dry which seemed to have somewhat hampered the thickening of the encrustation.

Predators played havoc with this crop throughout its life cycle. It took a little over five months to mature and was collected on 26th June 1931. The yield was about equal to the seed used. About 2¼ lb. of brood lac were carefully selected for infection and the rest immersed in water as it was infected with predators. As a matter of curiosity the encrustation on a few sticks was scraped and the predator larvæ found therein were collected and counted. The result was rather astonishing. It worked out on an average to 11 larvæ per inch of encrustation.

The half a maund of brood lac was priced at Ranchi at Rs. 22–8–0 and its transport by rail and road to Vannathiparai was Rs 11–3–0. Expenditure on items relating to cultivation amounted to Rs. 13–14–0.

82. The three crops grown on unpruned trees in accordance with the raiyats' method of cultivation in vogue in Bihar and Central Provinces mark the first stage in our lac experiments. The first crop had to contend against extremely adverse climatic conditions which were quite unusual, and as regards the other two, predators played havoc with them throughout their life cycle. But infected shoots which escaped damage produced thick encrustation in all the three crops. These, however, served our purpose, as they showed that,—

(i) the infected trees belonged to the type which is considered a good lac host,

(ii) the climatic conditions and other factors of the locality seemed suitable for the production of lac, and that

(iii) twigs with thick encrustation served as samples of the size of encrustation that can be produced by the local kusum.

The experiments helped to demonstrate the raiyats' method of cultivating lac and trained up the local staff in lac operations.

Experiments on pruned trees.

83. Though lac cultivation was started soon after the decision was taken to test the local host and the conditions of the locality for lac production according to raiyats' method of unpruned shoots, it was also decided to raise some experimental lac crops on pruned trees as well.

84. *Trees pruned and cost of pruning.*—Twelve trees were pruned in February 1930 at a cost of Rs. 19–13–0. While cutting the lac crops on the infected trees in the months on June–July and December–January, those trees were also pruned. From January to March 1931 a large number of trees were pruned in order to carry out infection on a large scale to determine the financial aspect of lac cultivation in this locality. The expenditure incurred on pruning these 122 trees was Rs. 187, i.e., Rs. 1–8–6 per tree. In August 1932, 21 trees were pruned at a cost of Rs. 9–6–0 and in March 1934 another 52 trees were dealt with for a sum of Rs. 30. In all 207 trees received preliminary pruning at a total cost of Rs. 246–3–0. The average cost of pruning a tree came to Rs. 1–3–0. The actual cost, however, varied with the size and shape of the crown, from 7 annas 3 pies to Rs. 1–10–6 per tree.

85. *Labour for pruning.*—When pruning was started in 1930 two days were wasted in trying the local village coolies (plainsmen) who were found mortally afraid to climb to the top of these trees to prune their branches. They were coaxed to make a beginning with a small tree which they did. But later on in the day when they were told to take up next a medium-sized tree they struck work and refused to do any further pruning of Kusum trees as they were mostly tall with large spreading crowns. They, however, suggested that Paliyans (hill men) were the only people who could climb to the very top of these trees and go to the end of each branch. But Paliyans were difficult to get.

A contractor who had engaged a batch of Paliyans to collect the local minor forest products was persuded to spare some of them for a few days. They are really expert climbers of trees but are not accustomed to lopping branches all day long and for days together at a stretch. The Paliyans secured from the contractor were, however, induced to do pruning at short intervals.

86. *Paliyan Settlement.*—It was evident that local plainsmen were quite unsuitable for pruning, infection and crop-cutting works and Paliyans alone have done it since the beginning of the lac operations. But Paliyans are very few in numbers and difficult to get when the lac work is on. They made us understand that they were not averse to settle down at Vannathiparai and do forest work if land is given them. To work this

big Kusum area successfully as a lac farm it is very essential to have a Paliyan Settlement close by. Without such suitable labour it would be quite impossible to get the 7,200 trees on the area pruned for lac operations. Definite proposals for the formation of a Paliyan Settlement at Vannathiparai by the grant of 2 acres of land, tax-free, to each family were therefore made to the Conservator of Forests and were approved by him. A settlement with 10 Paliyans was started in 1931. Lac operations, when expanded, will keep them fully employed over the greater part of the year. When they are not required for lac work they can devote themselves to the cultivation of their lands and to the collection of Minor Forest Produce from the adjoining reserves.

87. *Experiment I.*—Out of the $2\frac{1}{4}$ lb. of cleaned brood lac carefully selected from the local crop, $1\frac{3}{4}$ lb. were put on a kusum tree pruned in February 1930 and the balance of half a pound was tied to a *Zizyphus jujuba* pruned in May 1931. Infection was done by single sticks on 27th June 1931 and the males swarmed from the 24th of August to the 13th of September. The crop on *Zizyphus* was damaged by predators but their attack on the kusum crop was not so severe. The crops matured in December and were cut on 13th December 1931. The yield of brood lac from the *Zizyphus* was $9\frac{3}{4}$ lb. and from the kusum, $29\frac{1}{2}$ lb. making a total of $39\frac{1}{2}$ lb. which was nearly 17 times the seed used.

The total expenditure incurred, inclusive of washing of the yield, was Rs. 5–4–0.

88. *Experiment II.*—Eleven pounds of selected brood lac were put on one kusum tree on 14th December 1931 and transferred to another tree later on. These trees had been pruned in February 1930 and the shoots at the time of infection were 23 months old. Swarming was vigorous and the settlement on the shoots was rapid and satisfactory. Males swarmed from the 1st to the 25th of March. The crop developed well on both the trees and the new brood swarmed on 22nd June 1932. The yield from the first infected tree was 122 lb. and from the second tree infected by transfer it was about 48 lb.—in all 170 lb. of brood lac, nearly 16 times the seed used. After returning 34 lb. to Palghat (received for another experiment) the balance stock of 136 lb. was scraped and washed. It yielded 47 lb. of seed lac and $10\frac{1}{2}$ lb. of lac dust. Expenditure incurred on this crop was Rs. 13–6–0.

89. *Experiment III.*—The next crop was started with 118 lb. of brood lac which was put on six trees and transferred after four days to another four trees, all having shoots 18 months old.

In the two previous crops infection was done by single sticks, i.e., a piece of brood stick was tied to every suitable shoot on the tree. This method, besides being slow and costly, resulted in over infection of the shoots, necessitating early transfer of brood lac to other uninfected shoots or trees. It was therefore decided to select points of infection at places wherefrom large groups of suitable shoots arose. At each of these points a bundle of sticks were tied, instead of a half a dozen separate sticks. In actual practice it meant using the most suitable clumps of shoots for lac production and leaving out the other portions of the tree which had only a few scattered shoots, i.e., about two-thirds of a tree carried the lac crop and the rest was left uninfected. Such controlled infection minimises to some extent the great drain on the usual resources of the host tree and enables it to retain its vitality better.

Male swarming took place during September and the crop was harvested from the 14th to the 17th of December, 1932. The yield from the 6 trees infected first was 657 lb. but from the 4 trees infected by transfer was only 23 lb. The maximum yield from a single tree was 180 lb of brood lac. The total yield was nearly 6 times the seed used. Washed lac obtained from this harvest consisted of 263 lb. of seed lac and 34 lb of lac dust. The total expenditure incurred amounted to Rs. 46.

90. *Experiment IV.*—Out of the 680 lb. of stick lac obtained from the harvest, 320 lb. of brood lac were selected and tied to 12 trees pruned in February 1931. Infection was done in December 1932, mostly in bundles, while swarming was in progress. The practice of transferring brood lac from the trees infected first to other trees after a few days was discontinued. Trees infected by transfer of brood lac rarely produced in the previous crops a yield commensurate with the labour and expense involved. Further the necessity for transfer of brood lac was avoided by tying just the required quantity of brood lac at the first infection and removing it once for all after 10 or 12 days. This, as well as the more free use of bundles for infecting trees, helped to reduce the cost of infection to about half of what it was previously.

Fixation was good and males swarmed during March–April 1933. The new brood commenced to emerge on 11th June 1933. Each of the six trees gave good yields of 475 303, 273, 203, 178 and 164 lb. of stick lac. The total yield was, 2,026 lb. When scraped and washed it yielded 539 lb. of seed lac and 35 lb. of lac dust. Expenditure incurred on this crop totalled Rs. 58–9–0.

91. No brood lac was selected for infection from this crop as it was decided to bring this series of experiments to a close in view of the orders to restrict the production of lac to a minimum due to the unprecedented fall in the price of seed lac. Also another experiment to determine the financial aspect of lac production had been inaugurated and was in progress in this locality.

92. With a view to determine the financial aspect of lac operations at Vannathiparai, the Conseravator, Coimbatore Circle, ordered that 3 consecutive lac crops should be raised from January 1932 to July 1933, and that one maund of brood lac should be used for starting the first crop in January 1932. With the brood lac harvested in July 1932 the second crop should be started and the same process repeated in January 1933 to start the third crop which would mature in July 1933, when the whole of the harvested crop should be scarped and washed, to calculate the financial result.

93. But since the issue of the Conservator's orders the preparation of a Working Plan for lac operations in Madura district was taken up. It is therefore now considered advisable to work out the financial result based on all the crops which have been grown since the start of this financial experiment and for which full data are available. Results based on up-to-date figures, besides being more representative and reliable, are necessary for reviewing the operation as a whole up to the present stage and for working out the financial aspect of the proposed scheme.

94. *Crop No.* 1.—In accordance with the Conservator's order one maund (82 lb.) of kusum brood lac was purchased from the Chota Nagpur Lac Company, Limited, Ranchi, at a cost of Rs. 32–8–0. The Railway freight to Madura Junction and the cost of transport by bus and coolies to Vannathiparai amounted to Rs. 17–1–0. The consignment arrived on 23rd January 1932 and the brood lac was tied to three trees that had been pruned in July 1930. Swarming and settlement were satisfactory. After nine days the brood lac was transferred to three other kusum trees. The phunki lac was finally removed from the trees on 13th February 1932.

Male swarming occured from 23rd March 1932 to 8th April 1932, and the new brood emerged on 6th July 1932. The crop on the three trees first infected matured successfully but on the three trees infected by transfer it failed completely. The crop yields from each of the three trees first infected were 37 lb., 156 lb. and 174 lb., total, 367 lb. of stick lac. A sum of Rs. 2–13–0 was spent on the collection of the crop.

From the harvested stick lac 295 lb. of brood lac were selected for infection to start the second crop. Subsequently the whole quantity of 367 lb. was scraped, ground and washed at a cost of Rs. 8–15–0. The washed lac obtained consisted of 98 lb. of seed lac and 33 lb. of lac dust.

95. *Crop No.* 2.—The 295 lb. of selected brood lac were carefully examined for the larvæ and pupæ of the predators which were removed. The cleaned brood lac was tied to 12 trees on 6th to 8th July 1932 which were pruned in March 1931. After a week it was transferred to another 12 trees that were also pruned in March 1931. Inoculation was done by sticks as well as in bundles, and the phunki stick lac was finally removed from the trees on 20th July 1932. The charges for inoculation, cleaning of trees and removal of phunki lac came to Rs. 14.

Male swarming commenced on 12th October 1932. The condition of the crop on almost all the trees first infected was good, but on most of the trees infected by transfer it was poor. The crop matured in December and was harvested from 24th December 1932. The yield from each tree and the brood lac used for infecting it are given below :—

Statement showing the yield from each tree and the brood lac used for infecting them.

	Trees infected first.			Trees infected by transfer.		
	Tree number.	Brood lac used for infection.	Brood lac harvested.	Tree number.	Brood lac used for infection.	Brood lac harvested.
		LB.	LB.		LB.	LB.
	67	17	60	69	..	39
	68	44	231	73	..	82
	75	24	93	74	..	40
	76	42	210	84	..	45
	77	29	105	88	..	45
	79	18	83	89	..	49
	80	23	102	90	..	85
	81	17	127	116	..	60
	82	14	74	118	..	35
	83	23	123	119	..	29
	86	34	126	120	..	69
	87	10	27	121	..	20
Total ..	12	295	1,361	12	..	598

The crop yield was 1,959 lb. of stick lac and the cost of harvesting it came to Rs. 19–8–0. After utilizing 869 lb. of brood lac for starting the next crop the whole yield of 1,959 lb. was carted to Cumbum and washed at a cost of Rs. 78. The washed material was 625 lb. of seed lac and 123 lb. of lac dust.

96. *Crop No.* 3.—Out of the harvested lac 869 lb. of brood lac were selected and 34 trees pruned in February and March 1931 were infected between 10th to 19th January 1933. There was no transfer of brood lac to other trees and the phunki lac was removed from the infected trees after a fortnight. The inoculation charges came to Rs. 26–9–0.

This crop was subject to severe damage by predators. It failed completely on five trees and the encrustation on the remaining trees was far below the normal. The crop was cut in the last week of June 1933.

As there was a poor crop of lac scattered all over the crown of tree No. 52 it was decided to leave it uncut and to let the tree get naturally infected since it still had many infectable shoots. This exceptional treatment was given to it as a special case to show to the Range staff that under certain circumstances natural infection may be resorted to with a view to economy. This tree produced in December 1933 a bumper crop of 730 lb. of stick lac.

In South Raipur and Central Provinces, where kusum is fairly common, the method in use is to crop entirely well covered trees and allow them 2½ years rest, while lightly covered trees are allowed to go on for a second season and are then cropped and rested.

The crop yield from 29 trees was only 1,509 lb. of stick lac, not even double the seed used. The full quantity of 1,509 lb. was transported to Cumbum and washed. The proportionate expenditure in harvesting the crop and getting it washed was Rs. 29–8–6 and Rs. 29–5–10, respectively. Washed lac obtained consisted of 402 lb. of seed lac and 27 lb. of lac dust.

97. As the price of lac had slumped very low, orders were issued to close down lac operations till the price recovered to the usual level. It would have been a great folly however to have completely killed out the brood which had become thoroughly acclimatized to local conditions. The cultivation therefore, though restricted, was continued on a limited scale mainly with a view to conserve the local brood and have it ready at our disposal, in order to expand the operation whenever necessary. This was the reason why a small quantity of brood lac was selected for starting the next crop.

98. *Crop No.* 4.—The fourth crop was raised on a limited scale with 268 lb. of selected brood lac. Ten trees pruned in July 1931 were cleaned at a cost of Rs. 2–1–0 and infected from 23rd June to 2nd July 1933 for the first time when the shoots were two years old. Inoculation was done at the end of June 1933 and the charges came to Rs. 7–13–0.

Fixation and settlement were very satisfactory. The males emerged during October and the brood swarmed on 1st December 1933. The crop matured on seven trees only and the yield from them was 1,220 lb., which was carted to Cumbum and washed. The proportionate cost of collection of the crop and of washing it was Rs. 5–11–0 and Rs. 23–14–0, respectively. The yield of washed lac was 520 lb.

99. *Crop No.* 5.—The fifth crop was started in December 1933 with 605 lb. of selected brood lac tied to 15 trees pruned in August 1932. These trees were inoculated for the first time when their shoots were 16 months old, and the inoculation charges came to Rs. 15. Swarming was brisk and the settlement good. The crop developed well on all the trees except one on which it failed completely. Male swarming commenced in March and the new brood started emerging on 25th May 1934. This was the first instance of a crop maturing in May. It however took the usual period of nearly six months to mature.

The crop on all the 14 trees was harvested at a cost of Rs. 15. The crop yield from each tree is tabulated below :—

Statement showing the yield from the 14 *trees.*

Tree number.	Brood lac used for infection.	Brood lac harvested.	Tree number.	Brood lac used for infection.	Brood lac harvested.
	LB.	LB.		LB.	LB.
3,084	26	..	3,139	50	242
3,086	34	325	3,140	50	513
3,087	36	245	3,141	37	248
3,102	34	643	3,142	50	357
3,103	40	217	3,143	37	224
3,105	64	134	3,145	32	345
3,138	45	200	..	70	485
		Total ..	14	605	4,178

The average yield per tree was 298 lb. of stick lac and the quantity of brood lac used for infecting it worked out to 40 lb. The total yield was seven times the seed used.

82 lb. of selected brood lac were supplied to Upper Godavari for starting lac cultivation on *Zizyphus jujuba* and 166 lb. were sent to North Salem for infecting kusum trees in that division, and 1,423 lb. were used locally.

The phunki lac, along with what was cut from the naturally infected trees, was carted to Cumbum and washed. The proportional yield of washed lac was estimated at 1,633 lb. of seed lac and 120 lb. of lac dust, and the total cost of producing it was Rs. 178.

100. *Natural and other artificial crops.*—Besides the regular crops raised by artificial infection which have been described above, lac was gathered from a large number of naturally infected trees. How these trees became self-infected can only be guessed. Some of them were so close to the artificially infected trees that the lac larvæ may have crawled on to them or been blown and washed on to them by wind and rain during the swarming period. Some trees may have become infected from the debris left close to them after collecting the brood sticks. In one group it was due to the incomplete removal of crop at the time of harvest. Trees can get reinfected from the twigs left casually by accident or because of the very small bits of encrustation left ungathered on them.

Whatever may have been the cause of natural infection the yields from these trees during the harvests in December 1933 and June 1934 were quite as abundant as, or even more than, what was obtained from the artificially infected trees. Stick lac aggregating to 1,821 lb. was gathered from 14 such trees in December 1933 and 7,382 lb. from 70 trees in June 1934.

With 34 lb. of brood lac received from the Palghat division in June 1932, two crops were raised at Vannathiparai. Thirty-four pounds of brood lac put on pruned trees in June 1932 gave 186 lb. in December 1932 which again yielded 567 lb. in June 1933.

All the above yields were collected, washed and sold along with the artificially grown ones, referred to in paragraphs 94–99 above. It is advisable to keep a separate running record of crop yields from natural crops as it is likely that crops from naturally infected trees may recur in future.

101. *Results of experiments.*—The series of experimental crops grown on pruned trees with the local and the foreign broods which have been described above have yielded important results having a direct bearing on the future exploitation of this kusum area for the production of lac. The results are :—

(i) *Lac host.*—The Kusum trees at Vannathiparai belong to the type which is a good lac host. Trees infected after an interval of 16 to 24 months after pruning have given good crop yields. All the crops so raised have been quite successful.

(ii) *Climate.*—The most prominent of the climatic factors, viz., temperature and rainfall of the Cumbum valley, have been found suitable for the production of lac throughout the year.

(iii) *Lac crops.*—Two crops were grown in a year. We have named them as the " Summer crop " after the hot weather and the " Rains crop " after the rainy season. In North India they are called Jethwi and Aghani (Kusmi) after the Hindi months Jeth (approximately 15th May to 15th June) and Aghan (approximately 15th November to 15th December).

The period of life cycle of the lac insect on Kusum has varied from 163 days to 179 days. As the period of each crop has not been exactly six months, the times of infection and crop-cutting have been moving backwards from crop to crop. The 1932 Summer (Jethwi) crop was started on 20th January 1932, while the 1933 and the 1934 Summer crops were started on 24th December 1932 and 1st December 1933, respectively. Whilst the 1932 summer crop was harvested on 6th July 1932, the 1933 and 1934 crops were cut on 21st June 1933 and 26th May 1934, respectively. The rains (Aghani) crops too have behaved similarly.

A running record of the time taken by each crop will be found useful in future. The form appended may be adopted for recording the dates of swarming at infection and at crop-cutting.

The period of a lac crop is largely decided by the climatic conditions prevailing in a locality. At Thiruvazhankunnu in the Palghat division the summer crop took less than four months to mature. Infection was done in the beginning of February and the new brood swarmed before the end of May 1932. The South-West Monsoon commenced a day later.

(iv) The financial results of the foregoing experiments have been exhibited in a series of statements given under section 2 of Chapter VI, in Part I of this Working Plan.

History of Trees.

Tree number.	Gifth.	Condition of tree.	Date of prunning.	Date of infection.	Crop cutting. Date.	Yield.	Remarks.
						LB.	
1	8 feet.	Healthy. Big spreading crown.	20th January 1935.	24th May 1936 ..	17th November 1936.	430	Incrustation good and free from pests.
				12th May 1938 ..	1st November 1938 ..	430	Do.
				30th April 1940 ..	18th October 1940 ..	360	Incrustation poor. A few pests noticed.
				21st April 1942 ..	12th October 1942 ..	400	
				10th April 1944 ..	1st October 1944 ..	320	
2	6 feet.	Healthy: small crown.	20th January 1935.	24th May 1936 ..	17th November 1936.	280	Incrustation good.
3							
4							
5							

History of Kusum Lac Crop grown from——— to———.

Particulars.	Date or period.	Number.	Quantity.	Cost.	Remarks.
			LB.	RS. A. P.	
Trees infected—					
(*a*) Pruned	18th November 1934 to	44	..	33 11 0	
(*b*) Unpruned	14th December 1934.	127	..	46 4 0	
Pruning of the above trees (*a*).	11th June 1933 to 27th June 1933.	44	..	38 9 0	
Quantity of brood lac used ..	....	..	1,320	..	
Swarming at infection ..	17th November 1934.	..	..	..	
Trees cropped—					
(*a*) Artificially infected ..	11th May 1935 to 19th May 1935.	170	29,685	126 4 0	There was no crop on one tree.
(*b*) Naturally infected ..	....	9	760	6 8 0	
Swarming at cropping ..	16th May 1935 ..	..	..	..	
Yield of stick lac	....	..	30,445	..	
Yield of seed lac (large) ..	....	..	..	..	
Yield of seed lac (small) ..	....	..	..	..	
Yield of dust lac	....	..	..	..	
Yield of lac dye	....	..	..	..	
Cost of grinding, washing, etc.	....	..	..	140 9 6	
			Total ..	391 13 6	

Profit and Loss Statement.

EXPENDITURE.	RS. A. P.	REVENUE.	RS. A. P.
Total cost of production as above ..		By sale of stick lac	
Transport		By sale of seed lac	
Packing		Do.	
Railway freight		By sale of dust lac	
Brokerage, etc.		By sale of lac dye	
Testing fee, rebate, etc.		Miscellaneous	
Other charges			
Total ..		Total ..	

Note.—These headings are only indicative and are not exhaustive.

Proceedings of the Chief Conservator of Forests

Proceedings No. 290, Press, 7th June 1937

Working Plan—Madura Forest division—Sanctioned.

T. A. WHITEHEAD, Esq., I.F.S.,
Acting Chief Conservator of Forests.

READ—the following paper :—

Letter from the Conservator, Working Plans Circle, dated 30th June 1936, No. A. 761/32.

Proceedings—No. 290, Press, dated 7th June 1937.

Sanctioned.

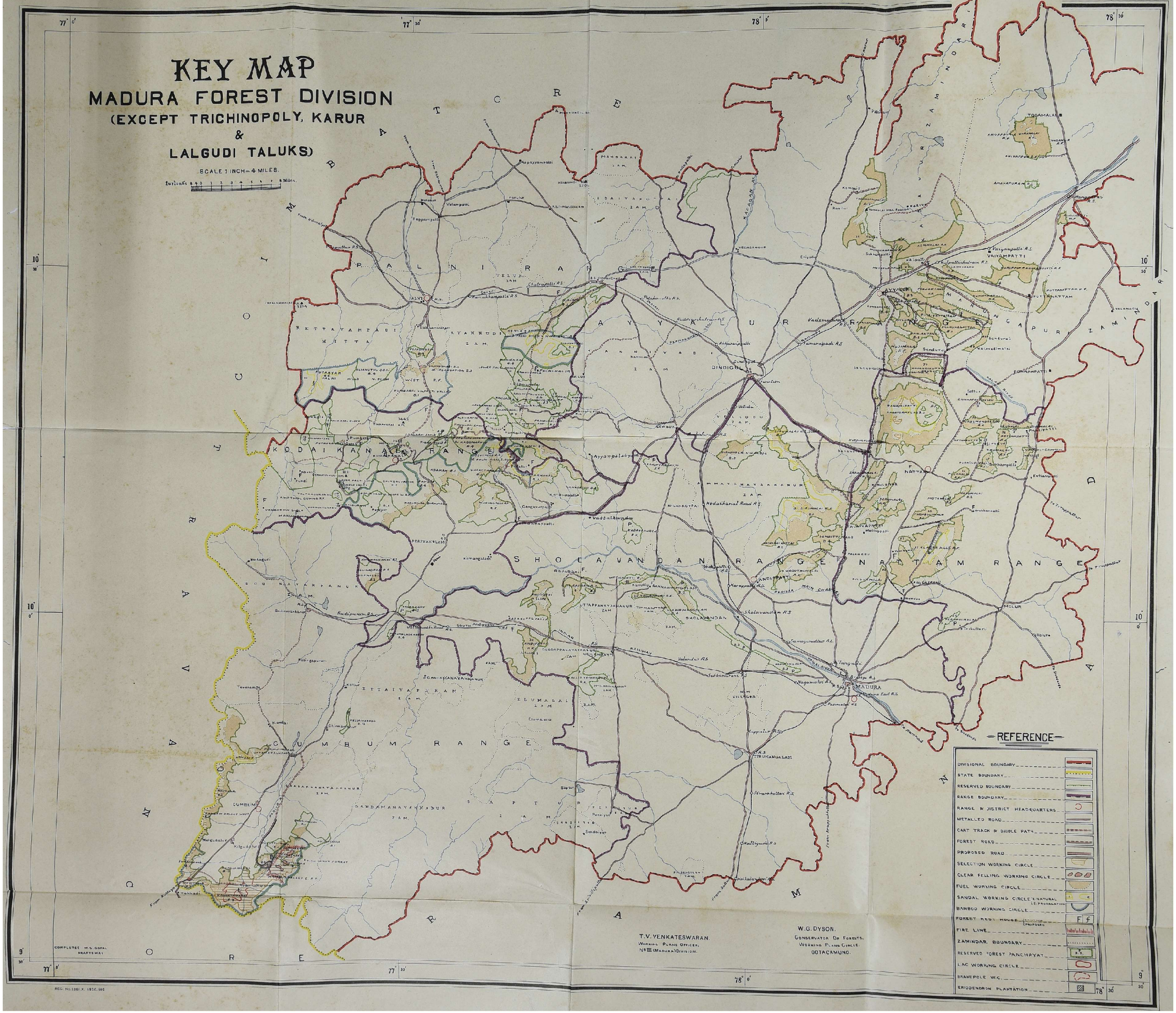
(True extract)

T. A. WHITEHEAD,
Acting Chief Conservator of Forests.

To the Conservator of Forests, Working Plans Circle, Coimbatore.
„ Collector of Madura.

Copy to other Conservators of Forests.
„ all other District Forest Officers.
„ the Principal, Madras Forest College.
„ the Provincial Silviculturist.
„ the Working Plans Officers.
„ the President, Forest Research Institute.

} Press copy.



KEY MAP
MADURA FOREST DIVISION
(EXCEPT TRICHINOPOLY, KARUR
&
LALGUDI TALUKS)
SCALE 1 INCH = 4 MILES.
PALNI RANGE
KODAIKANAL RANGE
AYYALUR RANGE
SHOLAVANDAN RANGE
NATTAM RANGE
CUMBUM RANGE
DINDIGUL
MADURA
REFERENCE
DIVISIONAL BOUNDARY
STATE BOUNDARY
RESERVED BOUNDARY
RANGE BOUNDARY
RANGE & DISTRICT HEADQUARTERS
METALLED ROAD
CART TRACK & BRIDLE PATH
FOREST ROAD
PROPOSED ROAD
SELECTION WORKING CIRCLE
CLEAR FELLING WORKING CIRCLE
FUEL WORKING CIRCLE
SANDAL WORKING CIRCLE 1. NATURAL 2. PROPAGATION
BAMBOO WORKING CIRCLE
FOREST REST HOUSE PROPOSED
FIRE LINE
ZAMINDAR BOUNDARY
RESERVED FOREST PANCHAYAT
LAC WORKING CIRCLE
BRAKEPOLE W.C.
ERIODENDRON PLANTATION
T.V. VENKATESWARAN.
WORKING PLANS OFFICER,
No III (MADURA) DIVISION.
W.G. DYSON.
CONSERVATOR OF FORESTS,
WORKING PLANS CIRCLE,
OOTACAMUND.
COMPLETED M.S. GOPAL DRAFTSMAN
REG. No. 1361. X. 1936. 100